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Water-Supply Paper 436

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART VI. MISSOURI RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
W. A. LAMB and ROBERT FOLLANSBEE, District Engineers

Prepared in cooperation with the
STATES OF COLORADO, MONTANA, AND WYOMING

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

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SURFACE WATER SUPPLY OF MISSOURI RIVER BASIN, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the prepartion of reports upon the best methods of utilizing the water resources.

Annual appropriation for the fiscal years ending June 30, 1895–1917.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50.000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 14.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth of inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 9).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.02	10.37	10.71
5	.4320	12.10	12.53	12.96	13.39
6	.5184	14.51	15.04	15.55	16.07
7	.6048	16.93	17.54	18.14	18.75
8	.6912	19.35	20.05	20.74	21.42
9	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second = 0.681818 miles per hour, or two-thirds mile per hour, very nearly; 1 mile per hour = 1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.499	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot = 0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water = 62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

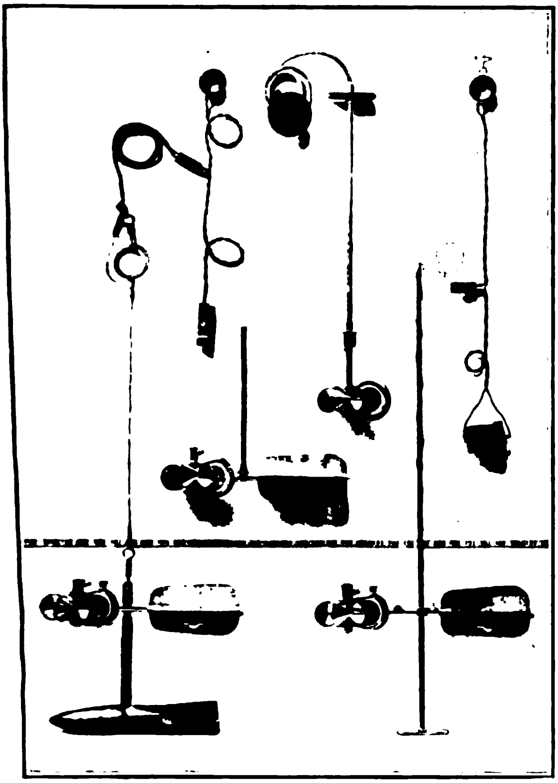
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

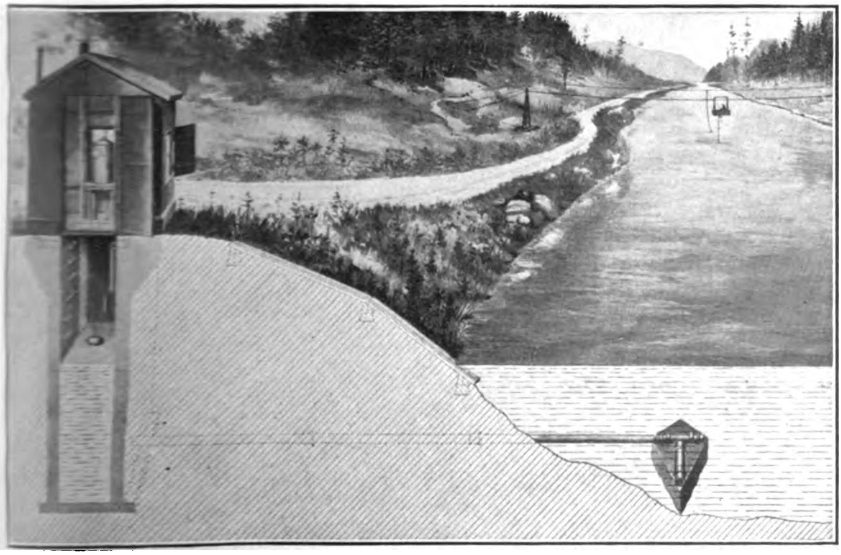
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid dirunal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

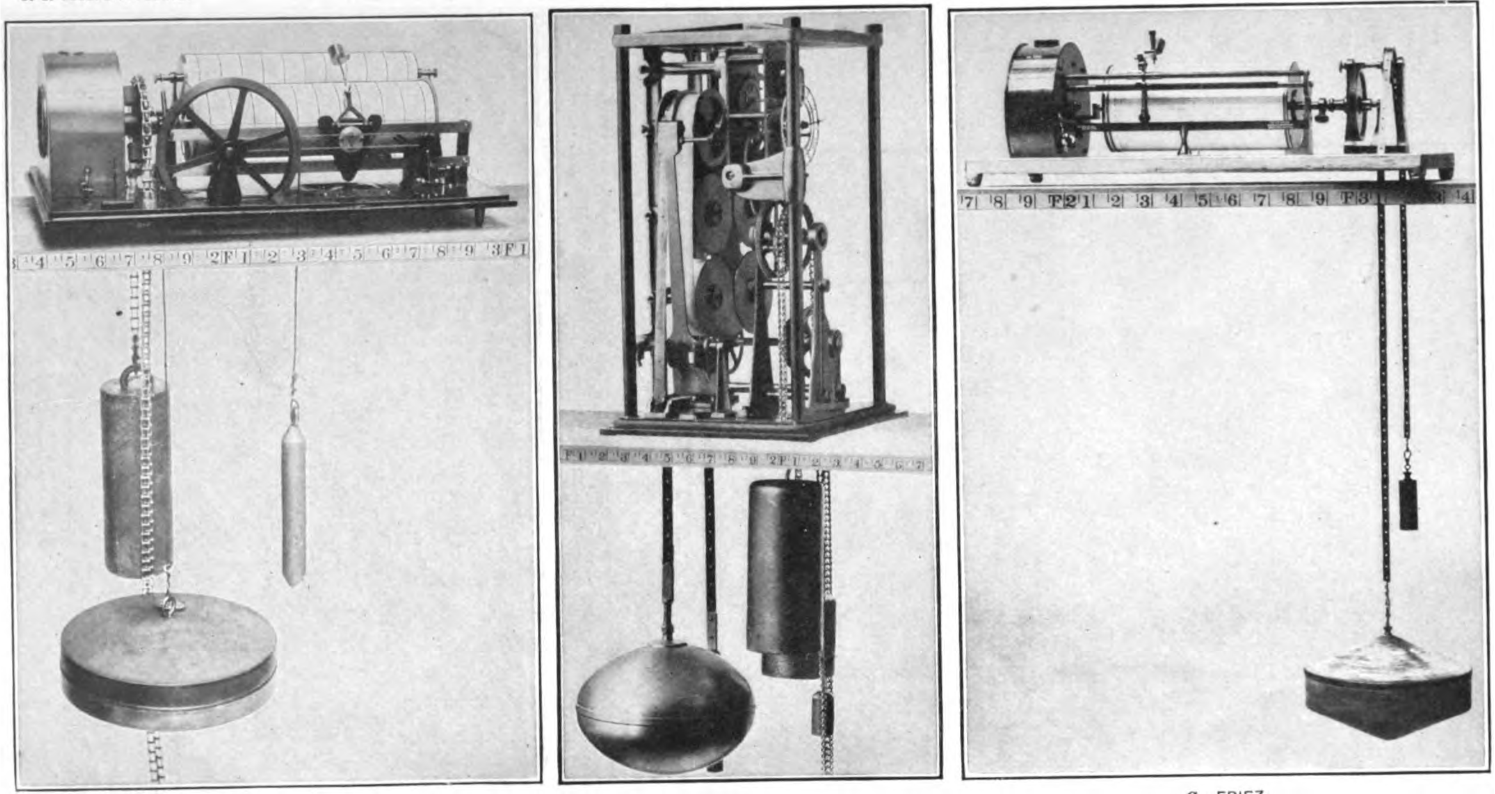
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the colunn headed "Mini-



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



A. STEVENS.

B. GURLEY PRINTING.

C. FRIEZ.

WATER-STAGE RECORDERS.

mum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 8, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanence of the stage-discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inabillty to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

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[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C., Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53-59, 1916.

COOPERATION.

Much of the work in Montana has been carried on under cooperative agreement with the United States Reclamation Service, the work being done by the Geological Survey and the expense borne by the Reclamation Service. The legislature of the State of Montana made an appropriation for stream-gaging work, which was expended by the State engineer, as provided in the act, in accordance with paragraph 3, section 2244, of the Revised Codes of 1907 of the State of Montana, which reads as follows:

> The State engineer shall become conversant with the waterways of the State and the needs of the State as to irrigation matters, shall make, or cause to be made, measurements and calculations of the ordinary and flood discharge of streams, cooperating n this work as much as possible with the United States Geological Survey and the Montana Experiment Station; such measurements to be made on streams in order of their importance, provided that measurements already made, if deemed reliable, may be adopted.

This fund was expended largely on work in connection with the several Carey projects in Montana and in computing data on water-right filings and adjudications. A State hydrographer was employed who worked directly with the Geological Survey.

The expense of work on the Crow Reservation in Montana, the Standing Rock Reservation in North and South Dakota, and the Pine Ridge and Rosebud Reservations in South Dakota was borne by the Office of Indian Affairs.

Officials of tle Yellowstone National Park have furnished valuable hydrometric and climatic data and paid a large part of the expense of work in the park.

All stations in Wyoming were maintained in cooperation with the State, through Mr. J. B. True, State engineer.

The United States Reclamation Service paid for the maintenance of the stations on North Platte River above Pathfinder, Wyo., on Sweetwater River near Alcova, Wyo., and on Sage Creek above Pathfinder, and also furnished complete records for certain stations, as acknowledged in connection with the descriptions of those stations.

The Hawk Springs Development Co., through Mr. J. A. Whiting, furnished record of gage heights and provided the transportation necessary to obtain data for the station on Horse Creek near Lagrange. Messrs. Johnson and Crownberg furnished gage-height records and other assistance in connection with the station on Medicine Bow River near Medicine Bow, Wyo., and Mr. F. H. Richards assisted in like manner in obtaining the record at the station on Muddy Creek near Shirley, Wyo. The Wyoming Irrigation Co. furnished gage-height records for Shell Creek at Shell, Wyo. The Rock Creek Conservation Co. furnished field data for stations on Rock and Deep creeks near Arlington, Wyo., and also transportation for Survey engineers.

The State engineer of Colorado paid the gage observers at the tions on the South Platte at South Platte, on the North Fork of South Platte at Grant and at South Platte, and on Geneva Creek Grant. The Tarryall Canal & Reservoir Co. paid the expense of taining the station on Tarryall Creek near Jefferson, Colo.

In South Dakota the Black Hills Angostura Irrigation Co. paid the ary of the gage observer at the station on Cheyenne River near Springs.

DIVISION OF WORK.

Data for stations in the upper Missouri River basin in Montana and rth Dakota were collected and prepared for publication under the ction of W. A. Lamb, district engineer, who was assisted by B. E. es, E. F. Chandler, A. H. Tuttle, and Mrs. A. H. Blom, and by S. Heidel, State hydrographer for Montana.

Data relating to tributaries of Missouri River in Colorado, South Dakota, and Wyoming were collected and prepared for publication der the direction of Robert Follansbee, district engineer, who was sisted by R. H. Fletcher, W. R. King, P. V. Hodges, H. K. Smith, H. Baily, and Miss Jane Hanna.

Data for three stations in the Yellowstone National Park were colted and prepared for publication under the direction of G. C. Baldwin, district engineer, who was assisted by H. J. Dean, C. G. Paulsen, and E. Hazel Haugse.

GAGING-STATION RECORDS.

MISSOURI RIVER PROPER.

RED ROCK CREEK BELOW RED ROCK RESERVOIR, NEAR MONIDA, MONT.

ation.—In sec. 32, T. 13 S., R. 6 W., at weir 150 yards below reservoir of Red Rock Reservoir & Irrigation Co., 8 miles northeast of Monida and 15 miles east of Lima, in Beaverhead County.

ainage area.—About 560 square miles.

rds available.—July 22, 1911, to September 30, 1916; also miscellaneous measurements made in summer of 1910.

age.—Stage determined by measuring with graduated rod the depth on a peg in concrete well set with its top at elevation of crest of weir. Observations made twice daily by P. V. Maxwell. Float gage in concrete well used in 1912 and 1913. During 1911 a temporary vertical staff on the left bank about 300 yards below the dam was read. Gage heights beginning with those for 1912 indicate head on crest of 40-foot weir about 150 yards below dam.

charge measurements.—Made from footbridge 40 feet above weir or by wading.

annel and control.—Bed composed of coarse gravel, pebbles, and boulders. Banks high; right bank is subject to overflow only during extreme high water. Current so swift at high stages that channel above weir, if cleaned out, soon becomes partly filled with rocks and pebbles, which cause considerable velocity of approach. Stage discharge relation seldom changes after natural deposit has been allowed to rest undisturbed.

Extremes of discharge.—Maximum stage recorded during year, 2.96 feet at 7 a. m. and 6 p. m. April 30 (discharge obtained by indirect method, 1,170 second-feet); minimum stage recorded, 0.28 feet January 16, 17, 18 (discharge, 23 second-feet).

1911-1916: Maximum stage recorded, 3.2 feet April 28, 1914 (discharge, 1,220 second-feet); minimum stage recorded, 0.10 foot January 1 to April 10, 1913 (discharge, 5 second-feet).

Ice.—Stage discharge relation not affected by ice.

Diversions.—None.

Regulation.—Dam is used to store flood waters to be released as required during irrigating season.

Accuracy.—Stage discharge relation changed by high water of April and May. Rating curve used to May 1 well defined; rating curve used after May 1 well defined between 200 and 500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating tables October 1 to April 22 and May 2 to September 30; April 23 to May 1 by indirect method. Results good.

Cooperation.—Record of daily gage heights furnished by Red Rock Reservoir & Irrigation Co.

Discharge measurements of Red Rock Creek below Red Rock reservoir, near Monida, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 1	Heidel and Maxwell	1.40	286
June 23	.....do	1.70	456

Daily discharge, in second-feet, of Red Rock Creek below Red Rock reservoir, near Monida, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	280	70	25	25	25	25	26	1,170	576	445	155	138
2	154	70	25	25	25	25	25	1,140	548	445	152	133
3	68	70	25	25	25	25	25	1,110	548	407	149	133
4	68	70	25	25	25	25	25	1,110	548	376	147	133
5	68	70	25	25	25	25	25	1,110	537	376	141	133
6	68	70	25	25	25	25	25	1,050	537	337	141	133
7	68	70	25	25	25	25	25	1,020	470	332	138	128
8	68	70	25	25	25	25	26	1,020	422	332	136	128
9	68	70	25	25	25	25	26	925	422	332	136	128
10	68	70	25	25	25	25	26	895	422	332	131	128
11	68	70	25	25	25	25	26	717	422	332	131	128
12	68	70	25	25	25	25	26	717	422	291	128	128
13	68	70	25	25	25	25	26	648	436	291	128	128
14	68	70	25	25	25	25	65	603	436	271	128	128
15	68	70	25	25	25	25	124	603	436	252	128	256
16	68	46	25	23	25	25	248	603	436	271	128	332
17	68	25	25	23	25	25	352	603	436	271	125	376
18	68	25	25	23	25	25	396	603	436	264	125	398
19	68	25	25	25	25	25	418	603	440	252	123	445
20	68	25	25	25	25	25	510	603	445	252	123	470
21	68	25	25	25	25	25	668	548	440	252	136	485
22	68	25	25	25	25	25	805	495	436	227	149	506
23	68	25	25	25	25	25	876	495	440	200	149	372
24	68	25	25	25	25	25	927	495	445	155	149	252
25	68	25	25	25	25	25	957	495	445	155	149	252
26	68	25	25	25	25	25	1,010	522	445	155	141	252
27	68	25	25	25	25	25	1,080	548	445	155	141	252
28	68	25	25	25	25	25	1,100	548	445	155	138	252
29	68	25	25	25	25	25	1,130	576	445	155	138	252
30	70	25	25	25	......	25	1,170	576	445	155	138	252
31	70	......	25	25	......	26	......	576	......	155	138	......

Note.—April 24 to May 10, 1916, water passed around weir; estimated by observer as follows:

	Second-feet.		Second-feet.
Apr. 24	7.5	May 1–5	30
Apr. 25	8.8	May 6–8	25
Apr. 26	12.5	May 9	12.5
Apr. 27–28	25	May 10	10
Apr. 29–30	30		

Monthly discharge of Red Rock Creek below Red Rock reservoir, near Monida, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	280	68	77.7	4,780
November	70	25	48.2	2,870
December	25	25	25.0	1,540
January	25	23	24.8	1,520
February	25	25	25.0	1,440
March	26	25	25.0	1,540
April	1,170	25	406	24,200
May	1,170	495	733	45,100
June	576	422	460	27,400
July	445	155	270	16,600
August	155	123	137	8,420
September	506	128	241	14,300
The year	1,170	25	206	150,000

BEAVERHEAD RIVER AT BARRATTS, MONT.

Location.—In SW. ¼ SW. ¼ sec. 20, T. 8 S., R. 9 W., at highway bridge where highway crosses railroad and where both highway and railroad bridges cross river, 1 mile above Barratts, in Beaverhead County, 2 miles below mouth of Grasshopper Creek, and 10 miles southwest of Dillon.

Drainage area.—Not measured.

Records available.—August 12, 1907, to September 30, 1916.

Gage.—Chain gage on downstream side of bridge; read by T. Masuno. Before June 22, 1908, a staff gage was used. Datum of chain gage same as that of staff gage.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Banks high, covered with brush, and not subject to overflow. Stream bed clean and rocky. Two channels at low and medium stages, caused by an old pier; sudden changes unlikely.

Extremes of discharge.—Maximum stage recorded during year, 4.2 feet at 3.50 p. m., June 22 (discharge, 2,150 second-feet); minimum stage, 0.90 foot, September 1–7 (discharge, 222 second-feet).

1907–1916: Maximum stage recorded, 6.0 feet, June 19 and 20, 1908 (discharge, 3,640 second-feet); minimum stage, 0.42 foot, June 23, 1910 (discharge, 114 second-feet).

Ice.—Stage-discharge relation at times affected by ice.

Diversions.—Numerous diversions are made above the station. Water rights aggregating 85,866 inches of water are decreed from Lima, on Red Rock Creek, to a point 10 miles above Twin Bridges. The three largest canals diverting below the station are Canyon Creek canal, appropriating 6,000 inches; Union canal, appropriating 4,000 inches; and Beaverhead canal, diverting just north of Dillon appropriating 5,000 inches. The Union Electric Co., of Dillon, has a canal, with a carrying capacity of 6,000 inches.

Regulation.—The dam on Red Rock Creek, near Monida, used to store flood waters, has some effect on the flow at this station.

Accuracy.—Stage-discharge relation unchanged during year. Rating curve fairly well defined. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by C. S. Heidel:

June 22, 1916: Gage height, 3.97 feet; discharge, 1,990 second-feet.

Daily discharge, in second-feet, of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	567	420	332	332	332	256	444	1,280	961	1,020	332	222
2	567	420	332	332	332	292	467	1,340	900	1,020	354	222
3	567	444	354	332	332	256	444	1,340	840	1,080	332	222
4	567	467	375	332	332	256	420	1,340	840	1,340	332	222
5	516	467	375	332	354	274	420	1,400	840	1,340	332	222
6	516	467	375	332	332	292	420	1,470	900	1,080	332	222
7	492	467	398	332	332	292	398	1,540	900	961	332	222
8	420	467	375	332	312	354	420	1,470	961	782	332	256
9	420	444	375	332	292	516	444	1,470	1,020	726	332	256
10	420	420	332	332	292	900	467	1,470	1,080	619	332	292
11	398	398	332	332	274	840	492	1,400	1,210	593	332	292
12	398	420	332	332	292	726	699	1,340	1,210	567	312	332
13	420	420	332	332	292	567	567	1,280	1,080	567	312	332
14	420	420	354	332	332	467	516	1,210	1,080	516	312	332
15	420	420	354	332	332	444	542	1,080	1,080	516	332	332
16	420	420	332	....	292	420	542	1,020	1,020	516	332	332
17	444	420	332	....	274	516	619	961	1,020	516	332	332
18	420	420	332	....	292	619	672	900	1,020	467	332	354
19	420	420	332	....	292	726	672	961	1,150	467	332	354
20	420	420	354	....	292	840	699	1,020	1,470	467	332	375
21	420	420	332	....	274	726	726	961	1,800	420	332	375
22	420	420	332	....	274	699	840	840	2,010	420	312	375
23	398	420	332	....	274	646	840	840	1,730	420	292	375
24	398	420	312	....	274	567	900	840	1,470	375	292	420
25	420	354	332	....	256	492	961	900	1,470	375	274	420
26	420	375	332	....	256	492	1,020	961	1,340	398	256	444
27	444	354	332	354	256	492	1,150	1,150	1,080	375	274	420
28	444	332	312	354	256	467	1,210	1,080	1,080	375	256	420
29	420	332	332	332	256	467	1,280	1,020	1,080	332	256	467
30	420	332	332	332	....	467	1,280	1,020	1,080	332	256	467
31	420	....	332	312	....	444	....	961	....	332	238	....

NOTE.—Discharge Jan. 2–15 determined from gage heights as estimated by observer because of effect of ice at gage. No gage height record Jan. 16–26.

Monthly discharge of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	567	398	447	27,500
November	467	332	414	24,600
December	398	312	343	21,100
February	354	256	296	17,000
March	900	256	510	31,400
April	1,280	398	686	40,800
May	1,540	840	1,160	71,300
June	2,010	840	1,160	69,000
July	1,340	332	623	38,300
August	354	238	311	19,100
September	467	222	330	19,600

JEFFERSON RIVER NEAR SILVERSTAR, MONT.

LOCATION.—In sec. 23, T. 2 S., R. 6 W., at highway bridge at Barkell's ranch, in Madison County, on road from Silverstar to Iron Rod, a station on Ruby Valley branch of Northern Pacific Railway, about 5 miles below junction of Beaverhead and Bighole rivers.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 11, 1910, to September 30, 1916, when station was discontinued.

E.—Vertical staff nailed to downstream side of rock-filled timber crib placed ar and two concrete piers at center of bridge; read by C. A. Barkell.

ARGE MEASUREMENTS.—Made from downstream side of highway bridge.

NEL AND CONTROL.—Bed gravel; practically permanent. Banks of medium height, covered with brush, and subject to overflow during extreme floods.

EMES OF DISCHARGE.—Maximum stage recorded during year, 7.75 feet at 8 a. m. and 5 p. m. June 23 (discharge, 13,500 second-feet); minimum stage 2.0 feet at 5 p. m. August 11, and at 8 a. m. and 5 p. m. August 12 (discharge, 465 second-feet).

10–1916: Maximum stage recorded, 8.8 June 15, 1913 (discharge, 16,500 second-feet); minimum stage, 1.7 feet August 22, 1910 (discharge, 320 second-feet).

—Stage-discharge relation seriously affected by ice; observations discontinued during winter months.

RSIONS.—Numerous irrigating ditches divert water above and below station.

LATION.—Flow regulated by two dams: One on Red Rock Creek, near Monida, stores water for irrigation, and one on Bighole River, near Divide, is used for power development.

ACY.—Stage-discharge relation practically permanent; rating curve well defined. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by C. S. Heidel:

20, 1916: Gage height, 7.4 feet; discharge, 12,100 second-feet.

Discharge, in second-feet, of Jefferson River near Silverstar, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	1,830	1,660	....	2,570	5,480	4.090	10,600	1,080	1,500
	1,830	1,660	....	2,370	6,220	4,090	10,000	1,080	1,500
	1,830	1,500	....	2,180	6.470	4,090	10,000	965	1,660
	1,740	1,350	....	2,180	6,730	4.320	9,730	965	1.830
	1,660	1,350	....	2,180	6,730	4,550	9.450	765	1,830
	1,830	1,350	....	2,470	6,730	4,550	9,450	678	2.000
	1,830	1,350	....	2,370	6,990	4,550	9,170	678	2,000
	1,830	1,350	....	2,180	6,990	4,780	9,170	678	2,000
	1.830	1,500	....	2,370	6,220	5,010	8,340	599	1.830
	1,830	1,660	....	2,370	5,480	5,720	8,070	599	1,830
	2,000	....	....	2,280	5,010	6,470	7,260	496	1,660
	2,000	....	....	2,990	4,780	6,990	6,730	465	1,660
	2,000	....	....	3,200	4,090	6,990	5,970	599	1,830
	2,090	....	....	3,420	4,090	7,260	5,480	765	1,830
	2,180	....	....	3,640	4,320	8,340	4,550	765	1,830
	2,180	....	....	2,280	4,550	9,170	3,860	965	1,830
	2,000	....	....	2,370	4,550	9,170	3,860	1,080	1,830
	1,920	....	....	2,280	4,320	9,450	3,420	1,210	2.000
	1,830	....	2,370	2,990	4,320	10,600	2,990	1,500	2,000
	1,830	....	2,370	3,200	4,320	12,300	2,780	1,500	2,000
	1,830	....	2,470	3,420	4,320	12,600	2.570	1,500	1,830
	2,000	....	2,370	3,640	4,550	13,200	2,180	1,660	1,830
	2,000	....	2,370	3,640	4,550	13.500	1,920	1,660	1,830
	2,000	....	2,180	3,860	4,320	12.000	1,830	1,350	1,920
	2,000	....	2,000	4,090	4,320	11,400	1,500	1,350	2,090
	1,830	....	2,180	4,550	4,320	11,200	1,660	1,350	2,180
	1,920	....	2,280	4,780	4,320	10,900	1,350	1,350	2,090
	1,830	....	2,570	4,780	4,320	11,200	1,350	1,280	2,000
	1,830	....	2,780	5,240	4,550	11,200	1,350	1,350	2,180
	2,000	....	2,780	5,480	4,320	10,600	1,210	1,500	2,180
	1,660	....	2,780	....	4,090	....	1,080	1,500	....

—Stage-discharge relation affected by ice Nov. 11 to Mar. 18. No gage-height record Dec. 30 to

Monthly discharge of Jefferson River near Silverstar, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,180	1,660	1,900	117,000
Nov. 1-10	1,660	1,350	1,470	29,200
Mar. 19-31	2,780	2,000	2,420	62,400
April	5,480	2,180	3,180	189,000
May	6,990	4,090	5,040	310,000
June	13,500	4,090	8,340	496,000
July	10,600	1,680	5,130	315,000
August	1,660	465	1,070	65,800
September	2,180	1,500	1,890	112,000

MISSOURI RIVER AT TOSTON, MONT.

Location.—In SW. ¼ sec. 23, T. 5 N., R. 2 E., at highway bridge crossing Missouri River at Toston, Broadwater County, about 25 miles below junction of Gallatin, Jefferson, and Madison rivers. Only large tributary between gaging station and headwater forks is Sixteenmile Creek.

Drainage area.—Not measured.

Records available.—April 5, 1910, to December 20, 1916, when station was discontinued.

Gage.—Chain gage attached to downstream side of bridge, about 30 feet from first pier from right bank; read by W. B. Lorentz.

Discharge measurements.—Made from cable just above bridge.

Channel and control.—Rocky; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 10.0 feet January 4 (stage-discharge relation affected by ice gorge); maximum stage recorded during open-water periods, 8.15 feet at 8 p. m. June 21 (discharge, 23,500 second-feet); minimum stage recorded, 2.1 feet at 5 p. m. December 31 (discharge, 1,560 second-feet).

1910–1916: Maximum stage recorded, 9.4 feet June 1, 1913 (discharge, 29,800 second-feet); minimum stage recorded February 10, 1914 (discharge estimated at 1,100 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Numerous diversions from tributaries above station.

Regulation.—Low-water flow partly regulated by Hebgen reservoir on Madison River.

Accuracy.—Stage-discharge relation permanent for open channel; seriously affected by ice January 1 to March 10. Rating curve fairly well defined. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

No discharge measurements were made at this station during the year.

Daily discharge, in second-feet, of Missouri River at Toston, Mont., for the period Oct. 1, 1915, to Dec. 20, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.										
	5,580	3,950	3,950	....	5,230	9,130	10,400	19,400	5,230	4,560
	5.230	3,950	3,950	....	5,580	9,560	10,400	20,400	4,890	4,250
	5.230	4.250	4,250	....	5,940	9,130	9,990	20,400	4,560	4.560
	5.230	4.250	4,560	....	5,580	9,130	10,400	19,400	4,890	4,250
	4.890	4,560	4,250	....	5,580	8,710	10,800	18,400	4,250	3,950
	4.890	4.250	4,250	....	5,580	9,990	11,700	19,400	4,560	5,230
	4.560	4.250	4.250	....	5,230	12,200	11,300	18,400	4,250	4.900
	4.560	3,950	4,250	....	5,230	12,600	11,300	16,400	4.250	4,560
	4.250	3.950	4,250	....	5,230	13,500	11,700	15,400	4,560	4.250
	4,560	3,950	4,250	....	5,580	13,100	12,600	15,400	4,250	5,230
	4.560	4,250	4.100	11.300	5,580	12,600	14,500	15,000	4.560	4,560
	4.250	3.950	3.950	10.800	6,690	12,200	15.000	13,500	4,560	4,560
	3.950	3.950	3.950	9,130	7,480	11,300	15,400	13,100	4,560	4,560
	3.950	3.950	4,560	8,300	7,480	11,300	14,500	11,300	4,560	4.560
	4,250	3,950	4,560	7,080	7,080	10,800	14,500	10,800	4,560	4,890
	3.950	4.250	4,250	7,080	7.480	9,990	15,000	10.800	4,560	4,250
	3.950	4.250	4,250	6,690	7,480	9,560	17,400	9,990	4,560	4,250
	3,950	4,250	3,950	7,480	7,480	9,130	18.400	9,130	4,560	4,250
	3.950	4.560	3,660	7,480	7,480	9,130	20.900	9,130	4,560	4,250
	3,950	4.560	3,660	7,480	7,480	9,130	22,400	8,300	4,560	4,560
	3.950	4.560	3,950	7.480	7.480	9,560	23,000	7,480	4,250	4,250
	3.660	4,560	4.250	6,690	6,690	10,400	22.400	6,690	4,250	3,950
	3.660	4,560	4,560	7,480	6,690	9,990	22,400	5,940	4,250	3.660
	3.660	5.230	3,950	7,080	6,690	9,990	20,900	5,230	4,560	3.950
	3,660	5,230	3,600	6,690	7,080	9,990	19,400	4,890	4,560	3,950
	3.660	4.560	3,240	5,940	7.480	10.400	18,400	5,580	4,890	3,950
	3.660	3,950	3,660	6,690	8,710	9,990	17,400	5,230	4.560	3,950
	3.950	4,250	3,950	6,690	9,130	9,990	17.400	5,230	4,250	3,950
	4.560	3,660	2,850	6,310	10,400	9,560	17,900	5,230	4,560	3,950
	4,250	3,950	1.820	5,230	9,990	9,990	19,400	5,230	4,560	3,660
	4.250	--------	1,640	5,580	....	9,990	....	5,230	4,560	....

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
				1916.				1916.			
	3,660	4.560	4.560	11........	4,560	4,560	4,250	21........	4,560	3,950	....
	3,660	4.560	4,400	12........	4,560	2,600	3,660	22........	5,230	4,560	....
	4,560	4,560	4,250	13........	4,560	1,820	3,950	23........	4,560	3,950	....
	4,560	4.250	4.560	14........	4,250	2,850	3,660	24........	4,560	4,250	....
	4.250	4,560	4,890	15........	4,560	4,560	4,250	25........	4,890	4,250	....
	4,250	4,560	4,250	16........	4,250	3,950	3,950	26........	4,560	4,560	....
	4,560	4.250	4,250	17........	4,250	3,660	4,560	27........	4,890	4,560	....
	4.560	4.560	3,950	18........	4,560	3,660	4,250	28........	4,560	4,560	....
	4,560	4,560	3,950	19........	4,250	4,560	4,560	29........	4,560	4,560	....
	4,560	4.560	3,950	20........	4,560	4,560	4,560	30........	4,560	3,950	....
								31........	5,230	....	....

NOTE.—Stage-discharge relation affected by ice Jan. 1 to Mar. 10 and Dec. 21–25, 1916; gage read but discharge not determined. On Dec. 25 channel was blocked solid with ice as high as bridge; water reached [illegible] feet, was turned from channel, and overflowed surrounding ranch lands.

Monthly discharge of Missouri River at Toston, Mont., for the period Oct. 1, 1915, to Dec. 20, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	5,580	3,660	4,280	263,000
November	5,230	3,660	4,260	253,000
December	4,560	1,640	3,890	239,000
March 11–31	11,300	5,230	7,370	307,000
April	10,400	5,230	6,890	410,000
May	13,500	8,710	10,400	640,000
June	23,000	9,990	15,900	946,000
July	20,400	4,890	11,500	707,000
August	5,230	4,250	4,530	279,000
September	5,230	3,660	4,320	257,000
1916.				
October	5,230	3,660	4,510	277,000
November	4,560	1,820	4,160	248,000
December 1–20	4,890	3,660	4,230	168,000

MISSOURI RIVER AT FORT BENTON, MONT.

Location.—In NE. ¼ sec. 26, T. 24 N., R. 8 E., at public highway bridge at Fort Benton, Chouteau County.

Drainage area.—24,600 square miles.

Records available.—July 1, 1902, to April 27, 1910, gage heights recorded by United States Weather Bureau; April 28, 1910, to September 30, 1916, United States Geological Survey records for parts of years.

Gage.—A Mott gage installed April 11, 1907, on upstream side of bridge; gage heights for 1911–1915 are referred to the datum used by the United States Army Engineers from 1881 to 1890, which is 0.43 foot higher than that used by the United States Geological Survey in 1910.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Practically permanent except in flood.

Extremes of discharge.—Maximum stage recorded during year, 9.25 feet at 8 a. m. June 23 (discharge, 50,600 second-feet); minimum stage recorded. 0.55 foot at 4.30 p. m. December 15 (discharge, 4, 120 second-feet).

1881–1916: Maximum stage recorded, 9.25 feet June 23, 1916 (discharge, 50,600 second-feet); maximum stage recorded by United States Weather Bureau, 15.3 feet June 7, 1908 (discharge not determined); minimum stage recorded, −0.2 foot September 10, 1914 (discharge, 2,250 second-feet); minimum stage recorded by United States Weather Bureau, −0.5 foot August 7–10, 17 and 18, 1910 (discharge not determined). Open-season records only; flow may have been lower during winter months.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Numerous above gage.

Regulation.—Low-water flow regulated by operation of power plants above station.

Accuracy.—Stage-discharge relation practically permanent for year except when seriously affected by ice, December 4–7 and January 4 to March 7. Rating curve well defined above 3,500 second-feet. Gage read to hundredths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Gage read but data inadequate for determining flow for period of ice affect. Records fair.

measurements of Missouri River at Fort Benton, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	2.61	10,800
	2.05	9,105
	1.36	7,360

ischarge, in second-feet, of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1916.

	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	7,400	5,700	6,700	4,500		6,700	14,000	22,300		9,600	6,000
	8,800	5,900	5,650	4,750		6,700	15,000	22,300		8,800	6,000
	8,800	6,100	6,000	5,000		7,050	15,500	22,900		8,800	6,000
	9,600	6,300	5,800			7,060	16,000	22,900		8,450	5,650
	10,000	6,500	5,600			7,400	17,000	22,900		8,100	6,000
	9,600	6,700	5,400			8,450	18,500	24,100		8,100	6,000
	8,800	6,700	5,200			8,450	18,000	23,500		8,100	6,000
	8,100	6,700	5,000			8,450	18,500	22,900		7,750	6,000
	8,100	6,000	5,300		8,450	8,450	18,500	22,900	21,200	7,400	6,000
	8,800	6,000	5,650		9,600	8,450	20,600	23,500	19,600	7,400	6,000
	8,100	6,350	5,650		9,600		21,200	23,500	19,000	7,050	6,000
	7,400	6,700	5,300		17,000		20,100	23,500	18,000	7,050	6,000
	7,400	6,350	5,300		20,100		19,000	23,500	17,000	7,050	6,000
	7,400	6,000	4,500		17,000		17,000	24,100	16,000	7,050	6,000
	7,400	6,000	4,250		16,500		17,000	25,300	16,500	7,050	6,000
	7,060	6,700	5,300		16,000		17,000	27,100	16,000	7,400	6,000
	6,700	7,050	5,300		15,500		16,500	30,100	15,500	7,400	6,000
	6,700	7,050	4,750		15,000		15,500	35,500	14,500	7,050	6,000
	6,350	7,400	4,750		15,000		14,500	35,500	14,000	7,050	6,000
	6,000	7,750	4,250		13,500		14,000	35,500	13,500	7,050	6,000
	6,350	7,580	5,300		12,500		14,000	36,800	13,500	7,050	6,000
	6,000	7,400	6,350		12,500	11,200	14,000	43,300	13,000	6,700	6,000
	5,650	6,700	6,000		12,500	11,200	14,500	48,900	12,500	6,700	6,000
	5,300	6,700	5,650		12,000	11,200	13,500	45,400	11,600	6,350	
	5,300	6,350	5,000		10,000	10,400	15,500	44,700	11,200	6,350	
	4,750	7,050	4,500		10,400	10,400	17,500	44,000	10,400	6,350	
	4,750	7,050	5,300		10,400	10,400	19,000	43,300	9,600	6,350	
	5,300	5,650	4,750		10,000	11,600	21,200	41,400	8,800	6,350	
	5,650	6,700	4,750		10,000	13,500	21,200	40.000	8,800	6,000	
	5,300	5,300	5,000		9,200	14,000	21,800	39,400	10,800	6,000	
	5,500		4,750		7,400		21,800		10,800	6,000	

—Mott gage broken and no readings taken Apr. 11–21 and after Sept. 23. No readings July 1–7. interpolated for following days: Oct. 31 to Nov. 5 and Nov. 21, owing to lack of gage readings; , owing to backwater from ice.

discharge of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber	10,000	4,750	7,040	433,000
ember	7,750	5,300	6,550	390,000
ember	6,700	4,250	5,260	323,000
9–31	20,100	7,400	12,600	575,000
1-10 and 22–30	14,000	6,700	9,530	359,000
	21,800	13,500	17,300	1,060,000
	48,900	22,300	31,400	1,870,000
–31	21,200	8,800	14,000	639,000
31	9,600	6,000	7,220	444,000
mber 1–23	6,000	5,650	5,980	273,000

MADISON RIVER BASIN.

GIBBON RIVER NEAR YELLOWSTONE, MONT.

Location.—In sec. 6, T. 14 S., R. 8 E. Montana meridian, about 500 feet northeast of Wylie-Gibbon lunch station, 2 miles below Gibbon Falls, 4 miles above confluence of Gibbon with Firehole River to form Madison River, and 16 miles east of Yellowstone and west boundary of Yellowstone Park.

Drainage area.—117 square miles (measured on topographic maps).

Records available.—June 22, 1913, to September 30, 1916, when station was discontinued.

Gage.—Vertical staff on left bank about 50 feet below concrete highway bridge; read by J. J. Dalton, a private stationed at the Fountain soldier station. Present gage used since September 14, 1913. Original gage, used June 22 to August 30, 1913, was vertical staff attached to downstream side of left abutment of old highway bridge, about 40 feet above site of present gage. A temporary gage installed by observer at site of present gage was read August 31 to September 14, 1913; readings on temporary gage have been reduced to datum of permanent gage.

Discharge measurements.—Made by wading at low and medium stages at a solid rock section about 30 feet above highway bridge.

Channel and control.—One channel at all stages. Bed of stream rocky and rough. Control consists largely of solid rock and is practically permanent. Little aquatic growth in stream near gage at any time. Control for present gage not the same as that for original gage; relation of the rating curves for the two gages not known.

Ice.—Stage-discharge relation not seriously affected by ice, as river is fed largely from geysers and hot springs; open-channel rating curve assumed applicable.

Extremes of discharge.—Maximum stage recorded during year, 3.8 feet at 2 p. m. June 21 (discharge not determined); minimum stage recorded, 1.4 feet October 30, November 1 and 27 (discharge, 72 second-feet). 1913-1916: Maximum stage recorded, 3.8 feet at 2 p. m., June 21, 1916 (discharge not determined); minimum stage recorded 1.3 feet March 10, 13, 17, 1915 (discharge 62 second-feet).

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation believed to have remained permanent throughout the year. Rating curve fairly well defined between 63 and 188 second-feet but not defined for higher stages. Gage read to half tenths once daily during summer months and during rest of year at intervals varying from three to five days. Discharge, except May 3 to July 8, ascertained by applying daily gage height to the rating table and interpolating for days on which gage was not read; May 3 to July 8 stage was above 2 feet and discharge was not determined. Record good July to September and fair October to May.

Discharge measurements of Gibbon River near Yellowstone, Mont., during the period Oct. 1, 1915, to Oct. 11, 1916.

Date.	Made by—	Gage height.	Discharge.
1916.		*Feet.*	*Sec.-ft.*
Aug. 3	Baldwin and Hoyt	1.80	139
Oct. 11	C. G. Paulsen	1.70	119

ischarge, in second-feet, of Gibbon River near Yellowstone, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.
	a87	72	a80	78	a90	92	a100	a162	....	162	109
	a89	a73	a81	a94	92	a92	a100	a156	....	139	118
	92	a74	a82	109	a92	a92	100	150	....	139	109
	a88	a76	84	a114	a92	92	a104	....	....	139	100
	84	a77	a84	118	92	a92	a108	....	....	162	100
	a84	78	a84	a115	a92	a92	a111	....	....	162	100
	84	a78	84	a112	a92	a92	a115	....	....	162	100
	a84	a78	a82	109	a92	92	118	....	....	162	109
	84	78	a81	a106	92	a97	a132	....	188	139	109
	84	a80	a80	a103	a95	a104	a146	....	188	139	100
	a87	a81	78	100	a97	109	a161	....	188	139	100
	a89	a82	a80	a100	100	a109	175	....	162	139	100
	92	84	a81	a100	a103	a109	a159	....	162	128	100
	a92	a84	a82	100	a106	a109	a144	....	162	118	100
	a92	a84	84	100	109	109	128	....	150	118	100
	92	a84	a84	a97	a104	a112	a126	....	162	118	100
	a89	84	a84	a95	100	a115	a123	....	162	139	100
	a87	a84	84	92	a100	118	a120	....	150	128	100
	84	a84	a84	a90	100	a125	118	....	150	139	100
	a82	84	a84	a88	a98	a132	a115	....	139	128	100
	a81	a81	a84	a86	a96	139	a112	....	139	118	100
	a80	78	84	84	a94	a150	109	....	139	118	100
	78	a77	a87	a84	92	162	a117	....	139	118	109
	a78	a76	a89	a84	a89	a156	a124	....	a139	118	a109
	a78	a74	92	84	a87	150	a131	....	a139	118	109
	a78	a73	a87	a84	84	a130	139	....	139	118	a104
	78	72	a83	a84	a86	109	a151	....	139	118	100
	a76	a74	78	a84	a88	a106	a163	....	139	118	a106
	a74	a76	a78	84	a90	a103	175	....	162	128	a112
	72	78	a78	a86	....	100	a169	....	162	118	118
	a72	....	a78	a88	....	a100	....	....	162	109	....

a Gage not read; discharge interpolated or estimated.

discharge of Gibbon River near Yellowstone, Mont., for the year ending Sept. 30, 1916.

[Drainage area, 117 square miles]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
er	92	72	83.6	0.715	0.82	5,140
ber	84	72	78.6	.672	.75	4,680
mber	92	78	82.7	.707	.82	5,080
ary	118	78	95.2	.814	.94	5,850
ary	109	84	94.6	.809	.87	5,440
h	162	92	113	.966	1.11	6,950
[illegible]	175	100	130	1.11	1.24	7,740
-31	188	139	155	1.32	1.13	7,070
st	162	109	132	1.13	1.30	8,120
ember	118	100	104	.889	.99	6,190

MADISON RIVER NEAR YELLOWSTONE, MONT.

Location.—In (approximately) sec. 5, T. 14 S., R. 6 E. Montana meridian, 250 feet downstream from old footbridge at fording place of old Gallatin trail, 300 feet north of stage road to Yellowstone, and almost immediately in front of Riverside soldier station; about 4 miles east of Yellowstone and west boundary of Yellowstone National Park. Gibbon and Firehole rivers unite to form the Madison about 8 miles upstream.

Drainage area.—410 square miles (measured on topographic maps).

Records available.—June 16, 1913, to September 30, 1916.

Gage.—Vertical staff on left bank; read by Sergeant Higinbotham, attached to the Riverside soldier station.

Discharge measurements.—High-stage measurements made from old footbridge 250 feet upstream from gage; medium and low stage measurements made by wading at gage.

Channel and control.—One channel at all stages. Bed of stream is gravel and boulders; somewhat rough. Control believed to be permanent. Aquatic growth is present during greater part of year and during summer months affects the stage-discharge relation.

Ice.—Stage-discharge relation not seriously affected by ice. Temperature of water, except during extremely cold weather, kept above freezing point by water from numerous hot springs and geysers.

Extremes of discharge.—Maximum stage recorded during year, 2.5 feet at 6 p. m., June 13 (discharge 1,770 second-feet); minimum stage recorded, 1.3 feet on numerous days from October to March (discharge 420 second-feet).

1913–1916: Maximum stage recorded 2.5 feet at 6 p. m. June 13, 1916 (discharge 1,770 second-feet); minimum stage recorded, 1.25 feet July 21–25, 1915 (discharge 370 second-feet).

Diversions.—None above station.

Regulation.—None.

Accuracy.—Stage-discharge relation believed permanent throughout the year except June 22 to August 10, when it was affected by growth of aquatic plants. Rating curve used October 1 to June 21 and August 11 to September 30 well defined below 1,400 second-feet; curve used July 4–29, well defined. Gage read once daily to half tenths. Discharge ascertained by applying daily gage height to rating tables except June 22 to July 3 and July 30 to August 10, for which periods shifting-control method was used. Records good.

Discharge measurements of Madison River near Yellowstone, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 27	Baldwin and Hoyt	1.51	568
Aug. 3	.....do	1.46	543
Sept. 19	C. G. Paulsen	1.40	521

[illegible] *discharge, in second-feet, of Madison River near Yellowstone, Mont., for the year ending Sept. 30, 1916.*

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	471	420	420	471	420	420	471	728	994	1,050	574	522
	471	420	420	471	420	420	471	728	1,050	1,100	518	522
	471	420	420	522	420	420	471	676	994	1,210	529	543
	420	420	471	522	420	420	471	676	1,110	923	541	522
	420	420	471	471	420	471	471	832	1,220	923	541	522
	420	428	471	471	471	471	471	939	1,340	923	605	522
	420	436	471	471	471	471	471	1,050	1,220	923	553	522
	420	444	471	471	471	471	471	1,050	1,310	869	666	522
	420	453	471	471	471	471	522	939	1,400	816	615	522
	420	462	471	471	471	471	522	939	1,520	816	615	574
	420	471	471	420	420	471	522	886	1,580	764	574	574
	420	471	471	420	420	471	625	832	1,160	764	574	574
	471	471	471	420	471	471	574	832	1,770	712	574	522
	471	420	471	420	420	471	574	780	1,280	712	574	522
	471	420	471	420	420	471	574	780	1,400	712	574	522
	522	420	420	420	420	471	574	728	1,460	712	574	522
	471	420	420	420	420	471	625	780	1,400	661	574	522
	471	420	420	471	420	471	574	780	1,520	661	574	471
	471	420	420	471	420	522	574	780	1,520	610	574	522
	471	471	420	471	420	574	574	832	1,580	610	574	522
	420	471	420	471	420	574	574	939	1,640	610	522	522
	420	471	471	471	420	574	574	939	1,390	610	522	522
	420	471	471	471	420	574	625	886	1,210	610	522	522
	426	471	471	471	420	522	625	994	1,080	558	522	522
	433	471	471	471	420	522	728	939	1,030	558	522	522
	439	420	471	471	420	522	728	939	1,070	558	522	522
	446	420	471	420	420	522	728	886	1,070	558	522	522
	452	471	471	420	420	522	728	939	1,120	558	522	522
	458	420	471	420	420	522	728	939	1,120	610	522	522
	464	420	471	420	......	471	728	994	1,050	563	522	522
	471	......	471	420	......	471	......	1,110	......	563	522	......

Note.—Discharge interpolated, for lack of gage readings, Oct. 24-30, Nov. 6-10, 23, June 5, 8, Sept. 21, [illegible]

Monthly discharge of Madison River near Yellowstone, Mont., for the year ending Sept. 30, 1916.

[Drainage area, 410 square miles].

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October	522	420	447	1.09	1.26	27,500
November	471	420	441	1.08	1.20	26,200
December	471	420	456	1.11	1.28	28,000
January	522	420	455	1.11	1.28	28,000
February	471	420	431	1.05	1.13	24,800
March	574	420	489	1.19	1.37	30,100
April	728	471	579	1.41	1.57	34,500
May	1,110	676	873	2.13	2.46	53,700
June	1,770	994	1,290	3.15	3.51	76,800
July	1,210	558	736	1.80	2.08	45,300
August	666	518	556	1.36	1.57	34,200
September	574	471	526	1.28	1.43	31,300
The year	1,770	420	606	1.48	20.14	440,000

PRICKLY PEAR CREEK BASIN.

PRICKLY PEAR CREEK NEAR CLANCY, MONT.

Location.—In sec. 34, T. 9 N., R. 3 W., at private wagon bridge back of ranch buildings on Stafford ranch, about a mile below Clancy and just below mouth of Lump Gulch Creek, in Jefferson County.

Drainage area.—Not measured.

Records available.—July 12, 1910, to September 30, 1916, when station was discontinued; July 15, 1908, to June 30, 1909, at old site, about a mile below; same quantity of water passes both sites.

Gage.—Staff gage nailed to downstream side of right abutment to wagon bridge; read by Miss Thane Haab.

Discharge measurements.—Made from wagon bridge or by wading.

Channel and control.—Bed of stream gravel and sand; slightly shifting. Banks subject to overflow at high stages.

Extremes of discharge.—Maximum stage recorded during year, 3.9 feet at 5 p. m. June 28 (discharge, 441 second-feet); minimum stage recorded, 1.5 feet March 30 and August 28 to September 2 (discharge, 38 second-feet).

1909–1916: Maximum stage recorded, 4.0 feet June 17, 1915 (discharge, 465 second-feet); minimum stage recorded, 1.4 feet August 4–26, 1910 (discharge, 12 second-feet).

Ice.—Stage-discharge relation seriously affected by ice. Observations discontinued during winter.

Diversions.—There are a few small diversions above station; flow appropriated and used for irrigation below station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 23 and 450 second-feet. Gage read to half tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records fair.

The following discharge measurement was made by W. A. Lamb:

June 17, 1916: Gage height, 2.44 feet; discharge, 159 second-feet.

Daily discharge, in second-feet, of Prickly Pear Creek near Clancy, Mont., for the year ending Sept 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	71	48	....	59	108	164	246	71	38
2	77	48	....	59	102	211	228	71	38
3	77	48	....	59	89	203	211	59	59
4	71	48	....	59	95	228	179	59	61
5	71	48	....	59	121	195	164	59	65
6	71	48	....	59	135	164	164	59	65
7	77	48	....	59	108	149	149	59	59
8	71	48	....	59	135	164	149	59	59
9	71	48	....	61	142	179	179	59	48
10	65	48	....	61	135	195	164	71	59
11	65	48	....	89	142	179	149	71	71
12	59	65	121	89	108	164	149	71	59
13	59	71	83	95	102	149	142	59	59
14	59	65	61	77	102	164	121	59	59
15	59	54	65	71	95	156	121	71	59
16	59	48	83	71	95	149	95	65	59
17	59	48	71	71	108	156	95	65	48
18	59	48	77	83	95	149	102	59	48
19	59	48	77	77	102	164	95	59	48
20	59	48	83	71	149	195	95	59	48
21	59	50	83	71	121	285	95	50	48
22	59	50	77	83	108	228	95	48	43
23	59	48	71	71	95	228	95	48	43
24	59	48	69	83	128	265	83	48	48
25	59	48	57	71	95	265	71	48	48
26	59	48	61	71	95	285	71	43	48
27	59	48	59	71	108	265	71	43	48
28	54	....	50	108	164	395	77	38	48
29	50	....	48	95	149	328	71	38	48
30	48	....	38	89	228	328	71	38	48
31	48	....	48	....	195	....	71	38	....

Note.—No gage readings Nov. 28 to Mar. 11.

ly discharge of Prickly Pear Creek near Clancy, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]	77	48	62.3	3,830
1-27	71	48	50.5	2,700
-31	121	38	69.1	2,740
[illegible]	108	59	73.4	4,370
[illegible]	228	89	121	7,440
[illegible]	395	149	212	12,600
[illegible]	246	71	125	7,690
[illegible]	71	38	56.3	3,460
[illegible]	71	38	52.6	3,130

TENMILE CREEK NEAR RIMINI, MONT.

CATION.—In NE. ¼ sec. 20, T. 9 N., R. 5 W., opposite Moose Creek ranger station, 500 feet above Moose Creek, 3 miles north of Rimini, in Lewis and Clark County,

AINAGE AREA.—Not measured.

CORDS AVAILABLE.—March 13, 1915, to September 30, 1916.

GE.—Friez water-stage recorder on left bank opposite ranger station; observer W. J. Derrick, a forest ranger.

SCHARGE MEASUREMENTS.—Made by wading just below gage.

ANNEL AND CONTROL.—Gravel and boulders; slightly shifting. Left bank high and steep; composed of loose material; subject to erosion but not to overflow; right bank sloping and subject to overflow.

TREMES OF DISCHARGE.—Maximum stage recorded during the year, 3.72 feet at 2 p. m. June 28 (discharge, 330 second-feet); minimum stage reported, 1.32 feet September 1 (discharge, 1.9 second-feet).

1915–1916: Maximum stage, 4.18 feet at 5 p. m. June 16, 1915 (discharge, 536 second-feet); minimum stage, 1.32 feet September 1, 1916 (discharge, 1.9 second feet).

E.—Stage discharge relation probably seriously affected by ice.

ERSIONS.—Small ditch diverts in summer for water supply of Helena.

ULATION.—Small reservoir of water-supply system of Helena is above the station, but operation of reservoir has probably little if any effect on the flow past the gaging station.

CURACY.—Stage-discharge relation not permanent; affected by ice in winter and by shift of control. Used three fairly well defined rating curves, applicable October 1–14, October 15 to August 1, and August 2 to Spetember 9. Mean daily gage heights, except during periods of large diurnal fluctuation, obtained from Friez water-stage recorder by inspection. Discharge ascertained by applying to rating table mean daily gage height, except for periods of large diurnal fluctuation, for which the discharge is the weighted mean obtained by using discharge for periods of different lengths for different days, in accordance with the fluctuations in stage. Records fair.

charge measurements of Tenmile Creek near Rimini, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 20	B. E. Jones	1.59	6.3	Apr. 1	W. A. Lamb	1.88	14.3
Dec. 20	W. A. Lamb	1.50	4.9	May 13	....do	2.75	90
Jan. 5	....do	[a] 1.48	4.3	June 6	....do	3.24	172
19	B. E. Jones	[a] 1.41	4.4	Aug. 31	....do	1.36	2.4
Feb. 12	W. A. Lamb	[a] 1.32	3.8				

[a] Stage-discharge relation affected by ice.

Daily discharge in second-feet, of Tenmile Creek near Rimini, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.0	8.2	......	......	......	......	14.3	79	177	172	13.2	2.3
2	9.0	8.2	......	......	......	......	14.3	78	164	148	10.8	2.4
3	8.7	8.5	......	......	......	......	15.0	89	179	143	10.0	21.5
4	8.4	8.5	......	......	......	......	14.3	114	214	122	9.5	12.2
5	7.8	8.5	......	a 4.3	......	......	14.3	134	209	110	9.0	10.0
6	7.8	8.5	......	......	......	......	14.0	173	209	100	8.7	10.2
7	6.9	7.2	......	......	......	......	14.9	180	209	92	8.4	9.5
8	6.6	5.8	......	......	......	......	17.3	152	204	85	8.1	8.1
9	6.9	......	......	......	......	......	17.8	143	229	104	7.8	3.0
10	7.2	......	......	......	......	......	20.0	130	205	92	7.6	......
11	7.2	......	......	......	......	......	37	117	173	73	7.4	......
12	7.2	......	......	......	a 3.8	......	44	104	156	66	7.2	......
13	7.2	......	......	......	......	......	38	92	158	60	7.2	......
14	7.2	......	......	......	......	......	44	88	173	56	7.2	......
15	7.6	......	......	......	......	......	51	86	192	51	6.9	......
16	6.3	......	......	......	......	......	52	92	187	46	6.9	......
17	6.3	......	......	......	......	......	53	92	166	55	8.1	......
18	6.2	......	......	......	......	18.6	51	95	154	54	8.5	......
19	6.2	......	......	a 4.4	......	20.3	48	114	130	42	8.3	......
20	6.1	a 6.3	......	......	......	25.0	45	139	122	37	7.8	......
21	6.0	......	......	......	......	23.5	46	140	112	33	7.3	......
22	5.3	......	......	......	......	21.9	52	141	117	29	6.8	......
23	4.8	......	......	......	......	19.5	51	142	132	25	6.3	......
24	4.5	......	......	......	......	19.0	50	143	154	24	5.8	......
25	4.5	......	......	......	......	18.6	64	144	190	23.5	5.3	......
26	4.5	......	......	......	......	17.1	66	146	209	22.5	4.8	......
27	4.8	......	......	......	......	17.8	102	148	172	22.0	4.3	......
28	5.8	......	......	......	......	16.6	111	144	245	23.0	3.8	......
29	6.3	......	a 4.9	......	......	14.6	96	164	241	20.5	3.3	......
30	7.8	......	......	......	......	14.6	80	186	209	18.0	2.8	......
31	7.8	......	......	......	......	14.3	......	173	......	15.6	2.4	......

a Discharge determined by current-meter measurement.

NOTE.—Discharge for following days interpolated, owing to lack of records or imperfect records: Oct. 17-20; Nov. 7; Apr. 16; May 10-12, 21-26; July 29-31; Aug. 1, 6-11, and 21-30.

Monthly discharge of Tenmile Creek near Rimini, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9	4.5	6.71	413
March 18-31	25	14.3	18.7	519
April	111	14.0	44.6	2,650
May	186	78	128	7,870
June	245	112	180	10,700
July	172	15.6	63.4	3,900
August	13.2	2.4	7.15	440
September 1-9	21.5	2.3	8.80	157

TENMILE CREEK NEAR HELENA, MONT.

LOCATION.—In SW. ¼ SE. ¼ sec. 22, T. 10 N., R. 4 W., opposite Broadwater Hotel, near Helena, in Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 8, 1908, to September 30, 1916.

GAGE.—Staff on right bank; read by J. W. Jackson.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge 500 feet below gage.

CHANNEL AND CONTROL.—Bed of stream coarse gravel and boulders; shifting occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.45 feet March 9 (discharge, 668 second-feet); minimum stage recorded, 1.70 feet February 9 and 10. (Discharge from current-meter measurement of February 9, 3.2 second-feet.)

1908-1916: Maximum stage recorded March 9, 1916; minimum stage recorded, 1.15 feet August 5 to September 10, 1910 (discharge, 0.15 second-foot).

—Stage-discharge relation seriously affected by ice.

RSIONS.—Part of the water supply for the city of Helena is taken from Tenmile Creek above the station. Two irrigation ditches also take water from the creek above the gage. The entire low-water flow is appropriated and used before it reaches the mouth of the creek.

LATION.—None.

RACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Rating curves used applicable as follows: October 1 to November 21, fairly well defined between 5 and 90 second-feet; November 22 to February 14, see footnote to table of daily discharge; February 15 to June 2, well defined between 4 and 80 second-feet; June 3 to September 30, fairly well defined between 10 and 300 second-feet. Gage read to half tenths once daily; accuracy of readings taken by substitute gage reader November 12 to December 30 and April 1-15, doubtful. Discharge ascertained by applying mean daily gage height to rating table. Records good except for short periods when stage-discharge relation was affected by ice or shifts in control, for which they are fair.

rge measurements of Tenmile Creek near Helena, Mont., during the year ending Sept. 30, 1916.

	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
	B. E. Jones	2.10	10.1	Feb. 9	B. E. Jones	a 1.70	3.2
	do	2.26	17.9	Apr. 18	W. A. Lamb	2.82	67
	W. A. Lamb	a 2.16	4.4	June 6	do	3.83	258
	do	a 2.01	6.8	Aug. 31	A. H. Tuttle	1.92	7.9
	B. E. Jones	a 1.83	4.3				

a Stage-discharge relation affected by ice.

scharge, in second-feet, of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	10	8	....	10.1	20	128	265	303	33	9.0
	10	8	....	10.1	20	141	265	275	30	9.0
	10	8	....	12.2	20	141	262	262	30	10.5
	13	8	....	12.2	20	159	262	262	30	15.0
	13	8	....	12.2	20	168	262	214	26	15.0
	13	8	....	12.2	20	178	262	183	26	17.5
	13	8	....	12.2	20	199	262	173	23	17.5
	16	8	....	30	20	178	275	163	23	17.5
	16	8	....	668	20	178	275	145	23	17.5
	16	8	....	114	20	159	275	145	23	17.5
	13	8	....	34	23	150	275	136	23	17.5
	13	8	....	30	23	150	249	128	23	12.8
	10	8	....	30	23	132	237	128	23	10.5
	10	8	....	30	30	106	237	112	23	10.5
	10	8	5.1	30	30	106	225	112	20	10.5
	10	8	8.7	30	48	114	225	97	20	12.8
	10	8	30	26	59	114	203	83	20	10.5
	10	8	23	26	66	123	183	83	20	10.5
	10	8	23	34	64	132	183	77	17.5	10.5
	10	8	20	34	58	159	183	66	15.0	10.5
	10	8	17.2	34	53	159	183	60	15.0	9.0
	10	....	12.2	34	53	159	193	50	15.0	9.0
	10	....	10.1	30	64	168	203	50	15.0	9.0
	10	....	10.1	30	64	168	203	50	12.8	9.0
	10	....	10.1	23	76	168	193	46	12.8	9.0
	8	....	10.1	23	123	168	193	41	12.8	10.5
	8	....	10.1	23	123	168	275	37	12.8	10.5
	8	....	10.1	23	123	178	438	33	10.5	15.0
	8	....	10.1	20	123	199	486	41	10.5	15.0
	8	....	....	20	123	242	454	37	10.5	12.8
	8	....	....	20	....	265	....	33	9.0	....

—Discharge estimated because of ice from gage heights, observer's notes, discharge measurements, and weather records, as follows: Nov. 22-30, 10 second-feet; Dec. 1-10, 12 second-feet; Dec. 11-20, second-feet; Dec. 21-25, 16 second-feet; Dec. 26-31, 7 second-feet; Jan. 1-5, 7 second-feet; Jan. 6-15, 6 second-feet; Jan. 16-25, 4.5 second-feet; Jan. 26-31, 4 second-feet; Feb. 1-14, 3.5 second-feet.

Monthly discharge of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	16	8	10.8	664
November			8.6	512
December			10.7	658
January			5.29	325
February	30		8.93	514
March	668	10.1	47.7	2,930
April	123	20	51.6	3,070
May	265	106	160	9,840
June	486	183	256	15,200
July	303	33	117	7,190
August	33	9.0	19.6	1,210
September	17.5	9.0	12.4	738
The year	668		59.1	42,900

LITTLE PRICKLY PEAR CREEK BASIN.

LITTLE PRICKLY PEAR CREEK NEAR MARYSVILLE, MONT.

Location.—At highway bridge on ranch of Casper Traufer, one-fourth mile below mouth of Deadman Creek, and 6 miles northwest of Marysville, in Lewis and Clark County.

Drainage area.—49 square miles (measured on topographic map).

Records available.—May 24, 1913, to September 30, 1916, at present site; April 12 to May 23, 1913, about one-fourth mile above present site; May 18, 1909, to December 31, 1911, at station formerly maintained above mouth of Deadman Creek.

Gages.—Vertical staff spiked to upstream side of left abutment of highway bridge; read by Casper Traufer. April 12 to May 23, 1913, vertical staff about one-fourth mile above present site; washed out by high water and replaced by present gage at different datum; discharge practically the same at the two points. Gage used May 18, 1909, to December 31, 1911, was a vertical staff on downstream side of Mr. Pearce's private bridge, one-half mile above the mouth of Deadman Creek.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Sand and gravel; shifts slightly.

Extremes of discharge.—Maximum stage recorded during year, 2.55 feet at 6 p. m. June 5 (discharge 204 second-feet); minimum stage, 0.90 foot February 20 to March 8 (discharge 6 second-feet).

1909–1911 and 1913–1916: Maximum stage recorded, 3.2 feet May 28, 1913 (discharge 315 second feet); minimum stage 2.28 feet (old gage) March 7–13, 1911 (discharge, 1.2 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Numerous small ditches take water from the stream, practically the entire normal flow being appropriated.

Regulation.—None.

Accuracy.—Stage-discharge relation changed probably during the high water in June. Rating curve used Oct. 1 to June 5 fairly well defined; curve used after that date well defined below 150 second-feet. Gage read to half tenths once daily except March 10 to August 1, when it was read twice daily. Daily discharge ascertained by applying mean daily gage height to rating tables. Records good.

rge measurements of Little Prickly Pear Creek near Marysville, Mont., during the year ending Sept. 30, 1916.

	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
	C. S. Heidel	1.92	103
	Lamb and Heidel	2.00	108
	Heidel and Lamb	1.20	19.0

discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1916.

	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	18	18	11		6	25	73	172	132	35	19
	18	18	11		6	25	63	156	124	35	19
	18	18	11		6	25	63	156	124	35	26
	18	18	11		6	25	69	180	116	35	22
	18	18	11		6	25	102	196	108	35	19
	18	18	11		6	25	132	174	93	30	19
	18	18	11		6	25	140	157	90	30	19
	18	18	11		6	27	124	140	79	30	19
	18	18	11		11	29	102	140	93	30	19
	18	14	11		42	31	91	140	82	26	19
	18	14	11		40	40	78	132	76	26	19
	18	14	11		35	47	73	124	69	26	19
	18	14	11		31	47	65	108	66	26	19
	18	14	11		25	52	63	108	64	26	19
	18	14	11		25	52	61	108	56	26	19
	18	14	11		29	52	54	108	52	26	19
	18	14	11		29	61	52	108	49	26	19
	18	14	11		29	63	52	108	49	26	19
	18	14	11		33	58	52	108	49	26	16
	18	14	11	6	35	52	52	108	49	26	16
	18	14	11	6	38	52	58	124	46	26	16
	18	11	11	6	33	52	63	124	44	22	16
	18	11	11	6	31	52	63	108	42	22	16
	18	11	11	6	29	52	65	100	40	22	16
	18	11	11	6	25	54	69	108	40	22	16
	18	11	11	6	27	61	69	108	40	19	16
	18	11	11	6	29	73	69	108	40	19	18
	18	11	11	6	29	82	82	108	40	19	19
	18	11	11	6	25	82	102	124	40	19	19
	18	11			25	78	132	124	40	19	19
	18				25		164		35	19	

—No gage-height record Dec. 30 to Feb. 19.

discharge of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber	18	18	18.0	1,110
mber	18	11	14.3	851
mber 1-29	11	11	11.0	633
ruary 20-29	6	6	6.0	119
[illegible]	42	6	23.5	1,440
[illegible]	82	25	47.5	2,830
[illegible]	164	52	80.5	4,950
[illegible]	196	100	129	7,680
[illegible]	132	35	66.7	4,100
st	35	19	26.1	1,600
ember	26	16	18.5	1,100

LITTLE PRICKLY PEAR NEAR CANYON CREEK, MONT.

Location.—In NW. ¼ sec. 9, T. 12 N., R. 5 W., near ford on Carbis ranch, below mouth of Canyon Creek, about 1¼ miles from Canyon Creek post office, in Lewis and Clark County.

Drainage area.—180 square miles (measured on topographic map).

Records available.—April 1, 1909, to December 31, 1911; April 12, 1913, to September 30, 1916.

Gage.—Vertical staff attached to tree on right bank about 40 feet above ford; read by E. D. Carbis.

Discharge measurements.—Made by wading near gage or from wagon bridge about 300 feet above gage.

Channel and control.—Sand and gravel; shifting. Banks overgrown with brush.

Extremes of discharge.—Maximum stage recorded during year, 4.2 feet, June 30 (discharge 395 second-feet); minimum stage, 1.9 feet September 2 (discharge 16 second-feet).

1909–1911 and 1913–1916: Maximum stage recorded, 4.8 feet May 29, 1913, (discharge, 665 second-feet); creek reported dry June 21–28, July 1–9, 21, 22, August 1–2, 1910; July 22–27, 29 and 31, 1911.

Ice.—Stage discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Many small ditches divert from the stream; practically all of low-water flow appropriated.

Regulation.—None.

Accuracy.—Stage-discharge relation affected by ice and by shifting control. Rating curve used October 1 to May 20 and June 10–29, fairly well defined; curve used June 30 to September 30 poorly defined. Gage read to half tenths once daily. Discharge ascertained by applying daily gage height to rating tables, except May 21 to June 9 for which it was determined by shifting-control method. Records fair.

Discharge measurements of Little Prickly Pear Creek near Canyon Creek, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 29	C. S. Heidel	3.40	197
June 26	Lamb and Heidel	3.70	226
Sept. 27	.....do	2.17	32.6

scharge, in second-feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1916.

Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
37	30	30	....	30	63	211	228	357	27	21
37	30	30	....	30	63	211	226	324	27	16
45	24	30	....	30	63	192	222	271	30	34
37	24	30	....	30	63	192	202	227	34	34
37	18	30	....	30	74	173	200	207	34	38
37	18	30	....	30	74	173	217	188	34	42
37	18	30	....	30	74	192	234	188	27	34
37	18	30	....	37	74	192	272	179	30	34
37	18	30	....	63	74	230	296	227	30	42
37	18	30	....	111	74	230	320	271	21	42
37	18	30	....	211	86	230	320	188	21	38
37	18	30	....	211	86	230	250	137	27	42
37	18	24	45	173	86	230	192	122	27	42
37	18	24	53	173	86	230	192	122	21	46
37	18	24	63	155	111	230	155	107	24	38
37	18	24	63	155	111	230	125	81	24	27
37	24	18	74	63	111	230	125	122	24	27
30	24	18	98	63	111	230	125	122	21	34
30	24	18	98	63	111	230	125	107	21	34
24	24	18	98	63	125	230	139	81	21	34
18	24	....	74	63	125	217	139	81	21	30
18	24	....	74	63	125	219	155	70	24	27
18	24	....	63	63	125	182	155	60	27	30
18	27	....	63	63	111	186	155	51	21	34
24	27	....	63	63	111	200	155	51	21	34
24	30	....	45	63	111	192	230	46	30	34
30	37	....	30	63	139	194	202	42	27	38
30	30	....	30	63	155	196	333	34	21	42
18	30	....	30	53	192	198	346	38	21	38
30	30	....	....	53	211	215	395	34	24	34
30	....	....	....	49	....	211	....	34	24	....

—Gage read Dec. 21 to Jan. 15, but data inadequate for determination of flow because of ice. No -height record Jan. 16 to Feb. 12.

discharge of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber	45	18	31.6	1,940
mber	37	18	23.4	1,390
mber 1-20	30	18	26.4	1,050
ary 13-29	98	30	62.6	2,110
rch	211	30	77.7	4,780
ril	211	63	104	6,190
ay	230	173	210	12,900
ne	395	125	214	12,700
ly	357	34	134	8,240
ust	34	21	25.4	1,560
ptember	46	16	34.7	2,060

SUN RIVER BASIN.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

LOCATION.—At Sun River diversion dam, 18 miles northwest of Augusta, Teton County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 1 to September 30, 1916, at the present site; August 5, 1889, to December 31, 1890; and October 31, 1903, to December 31, 1915, at the Henningson ranch, in sec. 33, T. 22 N., R. 7 W., 8 miles downstream from the present site. Flow of stream practically the same at both points, there being no large intervening tributaries and no diversions.

GAGE.—Sloping staff gage on right abutment of Sun River diversion dam; read by employees of the Reclamation Service; a Stevens water-stage recorder was in operation part of the year. Gage read October 31, 1903, to December 31, 1915, was an over-hanging chain gage on the left bank below the ranch buildings of the Henningson Company; that used from August 5, 1889, to December 31, 1890, was also near this point.

DISCHARGE MEASUREMENTS.—Made from footbridge about a half mile below dam.

CHANNEL AND CONTROL.—Control is crest of the Sun River diversion dam—a concrete structure with an arch section 153.3 feet long, and a gravity section 59.2 feet long, separated by a pier.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 11.4 feet June 21 (discharge, 32,300 second-feet); minimum stage recorded 0.4 foot February 28 to March 2, 1916 (discharge, 152 second-feet).

1889–1890, and 1903–1916: Maximum stage recorded June 21, 1916; minimum stage recorded, zero, April 7 and 8, 1915 (discharge, 15 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year except for old station at Henningson ranch, where it was affected by ice December 18-31. Rating curve used October 1 to December 17 for records obtained at Henningson ranch fairly well defined; curve used January 1 to September 30, for records obtained at present site, well defined. Discharge ascertained by applying mean daily gage height to rating tables. Records good.

Discharge measurements of North Fork of Sun River near Augusta, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
June 20	5.52	10,400	Aug. 11	1.18	862
July 12	3.32	4,350	Sept. 23	.73	440

Daily discharge, in second-feet, of North Fork of Sun River near Augusta, Mont., for the year ending Sept. 30, 1916.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	472	418	305	217	217	152	372	1,680	2,500	8,710	1,160	461
	472	472	305	217	217	152	372	1,840	2,500	10,200	1,130	461
	472	445	330	217	217	217	372	1,840	2,680	8,790	1,070	659
	472	445	315	217	217	254	372	2,680	2,680	7,050	1,070	1,260
	472	472	330	217	217	291	372	4,230	2,860	6,920	1,030	659
	500	445	330	217	217	291	557	4,890	3,820	6,180	944	608
	472	445	357	217	217	372	883	5,820	3,820	6,550	907	557
	472	445	384	217	217	372	883	3,820	4,230	7,180	907	461
	472	445	357	217	217	416	883	3,230	5,350	6,550	980	461
	472	445	384	217	217	416	883	2,680	5,580	5,870	944	461
	472	445	357	217	217	461	883	2,160	4,230	5,460	883	461
	472	472	306	217	217	461	883	2,000	4,450	4,670	883	461
	472	472	357	217	291	461	883	1,760	4,020	4,410	860	509
	500	500	330	217	291	461	883	1,600	4,670	4,340	825	557
	472	418	280	217	372	461	1,000	1,530	6,550	3,520	790	480
	472	418	216	217	372	461	1,390	1,530	8,790	3,420	745	461
	472	384	216	217	372	461	1,130	1,600	9,730	3,270	659	461
	472	357	216	217	461	461	1,130	1,760	9,940	2,900	659	461
	472	357	210	217	372	461	1,000	2,160	12,800	2,500	659	461
	472	418	210	217	217	461	1,000	2,680	12,800	2,240	659	461
	472	384	....	217	217	461	883	2,770	25,000	2,130	659	461
	472	357	....	217	217	461	883	2,860	14,500	2,030	659	461
	472	384	....	217	217	461	883	2,330	10,100	1,840	608	461
	472	418	....	217	217	461	883	2,160	9,440	1,680	608	461
	472	445	....	217	217	461	1,130	2,000	9,210	1,650	608	461
	445	357	....	217	217	461	1,690	1,840	9,270	1,680	608	461
	445	330	....	217	217	372	2,330	2,000	9,360	1,600	608	461
	445	280	....	217	152	372	2,860	2,160	11,100	1,530	557	461
	445	267	....	217	152	372	2,160	2,160	12,900	1,360	557	461
	418	280	....	217	....	372	1,810	2,330	10,400	1,200	557	461
	445	....	....	217	....	372	....	2,420	....	1,200	461	....

NOTE.—Discharge from Oct. 1 to Dec. 31 determined from gage-height record for chain gage at Henningson ranch, where flow is practically the same as at present site. Discharge Dec. 21–31 estimated at 210 second-feet.

Monthly discharge of North Fork of Sun River near Augusta, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	500	418	468	28,800
November	500	267	407	24,200
December	384	....	271	16,700
January	217	217	217	13,300
February	461	152	247	14,200
March	461	152	393	24,200
April	2,860	372	1,060	63,100
May	5,820	1,530	2,470	152,000
June	25,000	2,500	7,840	467,000
July	10,200	1,200	4,150	255,000
August	1,160	461	782	48,100
September	1,260	461	514	30,600
The year	25,000	152	1,570	1,140,000

NOTE.—See footnote to table of daily discharge.

SUN RIVER AT FORT SHAW, MONT.

Location.—In SW. ¼ sec. 1, T. 20 N., R. 2 W., just above highway bridge at Fort Shaw, Cascade County.

Drainage area.—Not measured.

Records available.—May 16, 1912, to September 30, 1916. A station on Sun River at Sun River, maintained July 31, 1905, to December 31, 1912, gave records for practically the same drainage area.

Gage.—Staff gage installed September 1, 1913, on right bank about 400 feet above highway bridge; read by C. G. Peterson, an employee of the United States Reclamation Service; stage prior to September 1, 1913, measured by chain gage fastened to footbridge near right bank and 1,000 feet downstream. Gages referred to different datums.

Discharge measurements.—Made from highway bridge below gage or by wading.

Channel and control.—Bed of stream, gravel and rock; fairly permanent; shifting only at extremely high stages. A ledge about 150 feet below the gage forms principal low-water control. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 10.4 feet at 6 a. m. June 22 (discharge, 17,500 second-feet); minimum stage recorded, 2.08 feet December 20 (discharge, 240 second-feet by current-meter measurement of same date; stage-discharge relation affected by ice; a lower discharge probably occurred during winter season).

1905–1916: Maximum stage recorded, 13.4 feet June 7, 1908 (discharge, 18,400 second-feet); minimum stage recorded at Sun River, 1.3 feet September 14, 1906 (discharge, 47 second-feet), and at Fort Shaw, 1.65 feet August 5, 6, and 8, 1914 (discharge, 95 second-feet). The high-stage discharge at Fort Shaw and Sun River is practically the same, but at low stages the operation of Sun River canal (capacity about 50 second-feet), which takes out between the stations, may cause a material difference.

Ice.—Stage-discharge relation seriously affected by ice. Observer's notes relative to ice very meager.

Diversions.—There are adjudicated rights for diverting 248 second-feet from Sun River direct and 664 second-feet from tributaries above this station. In addition the Fort Shaw canal of the United States Reclamation Service takes out about 200 second-feet during the irrigation season.

Regulation.—Willow Creek reservoir has a capacity of 84,200 acre-feet.

Accuracy.—Stage-discharge relation fairly permanent except for a considerable change caused by flood in June; seriously affected by ice. Rating curve used October 1 to June 21, well defined between 400 and 3,000 second-feet and fairly well defined to 11,000 second-feet; curve used June 22 to September 30, well defined below 1,500 second-feet. Gage read to tenths (occasional readings to half-tenths) twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Sun River at Fort Shaw, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 8	2.43	639	May 26	3.62	2,240	Sept. 23	2.00	982
Dec. 20	[a]2.08	240	June 20	7.90	10,300	Nov. 6	1.70	590
Apr. 20	2.90	1,130	Aug. 12	2.04	1,070			

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Sun River at Fort Shaw, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	710	710	610	---------	330	510	1,760	3,020	10,100	1,700	590
	560	710	610	---------	270	491	1,530	3,020	9,640	1,670	590
	610	660	510	---------	330	472	1,760	3,020	11,500	1,400	652
	610	660	510	---------	396	453	2,420	2,380	9,430	1,400	782
	660	610	462	---------	415	453	3,380	4,820	7,440	1,260	850
	710	660	415	---------	415	453	4,460	4,640	6,870	1,020	850
	660	660	415	---------	415	434	5,550	3,920	7,060	985	782
	710	610	372	---------	610	434	4,280	4,100	8,020	985	715
	560	660	372	---------	1,030	415	3,380	5,000	7,630	985	652
	610	560	372	---------	1,600	434	2,840	5,180	7,630	1,050	782
	660	610	372	---------	1,260	570	2,380	4,820	6,680	1,020	782
	710	610	372	---------	1,030	710	1,920	4,280	6,110	985	1,020
	560	560	330	---------	920	920	1,760	3,920	5,730	985	1,330
	610	660	372	---------	815	1,030	1,680	4,280	4,970	985	1,260
	610	610	330	---------	710	1,260	1,600	5,550	4,610	985	1,260
	610	660	320	4,280	660	1,260	1,460	7,100	4,250	985	1,090
	610	660	300	3,200	610	1,200	1,390	8,100	4,250	850	1,020
	610	610	280	2,160	660	1,140	1,530	8,900	4,250	918	1,020
	560	660	260	868	660	1,080	1,840	8,900	3,890	985	1,020
	610	610	240	868	610	1,030	2,330	10,300	3,260	918	1,020
	560	610	---------	762	868	975	2,500	14,400	3,010	850	1,050
	610	610	---------	762	815	920	2,500	17,000	2,840	850	985
	610	560	---------	660	710	920	2,160	13,500	2,670	850	985
	610	610	---------	660	660	920	2,160	10,900	2,500	850	782
	660	560	---------	660	610	1,090	2,160	10,100	2,420	652	590
	610	610	---------	660	610	1,260	2,000	10,100	2,330	590	590
	660	610	---------	610	610	2,000	2,160	10,300	2,330	474	532
	660	560	---------	610	590	2,670	2,500	11,300	2,160	474	590
	610	610	---------	415	530	2,670	2,670	12,600	2,080	474	590
	660	560	---------	---------	510	1,840	2,840	12,400	2,000	474	590
	660	---------	---------	---------	491	....	2,840	....	1,850	532	....

NOTE.—Stage-discharge relation affected by ice Dec. 9-10, and Dec. 16 to Feb. 15. Discharge Dec. 9 and [illegible] interpolated; Dec. 16-20, from discharge measurement of Dec. 20; Dec. 21-31, mean discharge estimated [illegible] second-feet, on basis of temperature records and measurement of Dec. 20. Data inadequate for determination of discharge, Jan. 1 to Feb. 15, owing to effect of ice.

Monthly discharge of Sun River at Fort Shaw, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	710	560	628	38,600
November	710	560	622	37,000
December	610	....	330	20,300
February 16-29	4,280	415	1,230	34,200
March	1,600	270	669	41,100
April	2,670	415	1,000	59,500
May	5,550	1,390	2,440	150,000
June	17,000	3,020	7,630	454,000
July	11,500	1,850	5,150	317,000
August	1,700	474	938	57,700
September	1,330	532	845	50,300

WILLOW CREEK NEAR AUGUSTA, MONT.

LOCATION.—In NW. ¼ SW. ¼ sec. 26, T. 21 N., R. 7 W., at Clark Co.'s ranch, just below mouth of Little Willow Creek and about 7 miles northwest of Augusta, in Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 8, 1905, to May 14, 1911; April 1, 1912, to September 30, 1916.

Gage.—Chain on right bank, 300 feet back of Thomas Clark's house; read by Thomas Clark.

Discharge measurements.—Made by wading or from bridge 1,000 feet below gage.

Channel and control.—An old dam of timber and rock 20 feet below gage forms the principal control; shifts slightly at long intervals.

Extremes of discharge.—Maximum stage recorded during year, 10.8 feet June 23 (discharge, 1,150 second-feet); minimum stage recorded, 0.60 foot January 31 and February 1-14 (discharge, 6.3 second-feet).

1905-1916: Maximum stage recorded, 10.8 feet June 23, 1916 (discharge, 1,150 second-feet); minimum, "dry" July 17, 1910.

Ice.—Probably no ice forms at this station, as a large spring enters the creek just above gage, but record of winter flow should be used with caution. February 15-17 stage-discharge relation seriously affected by ice gorge; flow not computed.

Diversions.—Adjudicated water rights above station amount to 36.2 second-feet from Willow Creek and 42.26 second-feet from tributaries. The United States Reclamation Service has an old right of 2.1 second-feet and has also filed on the total flow of the creek, subject to prior appropriations. No water diverted from Willow Creek proper below station, the amount used by the United States Reclamation Service being diverted from Sun River below mouth of Willow Creek.

Regulations.—None. Willow Creek dam, about 2 miles below station, forms a reservoir with a capacity of 84,320 acre-feet, for use on the Fort Shaw unit of the Sun River project. In addition to the flow of Willow Creek, water will be diverted from North Fork of Sun River for storage in this reservoir.

Accuracy.—Stage discharge relation not permanent; affected by shifting control, and occasionally slightly affected by ice. Used rating curves applicable as follows: October 1 to February 14, fairly well defined; February 18 to June 23, well defined between 30 and 100 second-feet, and fairly well above 100; July 1 to September 30, well defined between 25 and 700 second-feet. Gage read to half tenths once daily. Discharge ascertained by applying daily gage heights to rating tables except June 21, 22, and 26-30, for which it was determined by comparison with records of flow for station at Chouteau. Records fair October 1 to February 17; good for rest of year.

Discharge measurements of Willow Creek near Augusta, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 7	1.38	28.4	June 18	3.70	187	Aug. 11	1.80	64
Dec. 18	.80	9.3	25	7.65	642	Sept. 24	.91	28
Apr. 20	1.75	37.7	July 12	3.89	212			

charge, in second-feet, of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1916.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	29	21	14	9.4	6.3	14	28	46	195	460	76	36
	27	21	13	9.4	6.3	13	28	43	195	558	69	38
	27	21	13	9.4	6.3	13	28	49	195	496	64	59
	27	21	17	9.4	6.3	16	28	55	215	388	66	44
	27	21	17	9.4	6.3	18	23	58	255	342	69	38
	27	21	10	9.4	6.3	18	26	65	235	298	66	36
	29	21	17	9.4	6.3	16	28	72	225	320	64	36
	29	21	14	9.4	6.3	20	30	65	215	342	62	34
	29	17	19	9.4	6.3	76	32	58	215	320	64	38
	27	16	17	9.4	6.3	125	35	55	215	257	64	36
	27	14	17	9.4	6.3	76	38	55	109	220	64	36
	27	14	14	8.4	6.3	55	40	52	101	202	59	34
	27	14	11	9.4	6.3	46	40	49	93	176	56	32
	25	13	14	9.4	6.3	35	43	46	86	168	54	32
	25	16	14	9.4	....	30	46	46	86	160	50	32
	25	17	11	7.8	....	28	43	46	125	152	46	31
	23	17	10	7.8	....	28	43	43	176	176	66	31
	23	17	9.4	7.8	121	30	40	43	185	168	59	31
	23	17	11	7.8	58	32	40	46	195	137	48	30
	23	17	11	7.8	40	40	43	49	255	123	46	30
	23	19	14	7.8	23	40	38	49	900	116	46	30
	21	21	14	7.8	23	30	35	49	1,000	109	42	30
	21	23	16	7.8	23	30	32	49	1,150	103	42	30
	23	25	11	7.8	23	28	35	55	880	97	40	28
	23	14	11	7.8	23	26	35	52	642	97	40	28
	23	13	14	7.8	20	26	40	72	540	97	40	28
	21	16	13	7.8	20	32	46	125	470	97	38	32
	21	14	11	7.0	20	28	55	141	550	91	36	30
	21	14	11	7.0	18	26	52	141	400	97	36	28
	21	14	10	7.0	....	23	49	158	800	97	34	28
	21	....	9.4	6.3	....	24	....	141	....	85	34	....

—Discharge, Feb. 15–17, not computed on account of ice gorge below gage; stage rose to 8.1 feet on

Discharge, June 24, interpolated.

discharge of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber.	29	21	24.7	1,520
ber	25	13	17.7	1,050
mber	19	9.4	13.2	812
ary	9.4	6.3	8.45	520
[illegible]	125	13	33.6	2,070
[illegible]	55	23	37.2	2,210
[illegible]	158	43	66.9	4,110
[illegible]	1,150	86	363	21,600
[illegible]	558	85	211	13,000
st	76	34	52.9	3,250
ember	59	28	33.5	1,990

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

CATION.—In NW. ¼ SE. ¼ sec. 17, T. 20 N., R. 6 W., at highway bridge on road from Augusta to Craig, about half a mile from Augusta, in Lewis and Clark County.

AINAGE AREA.—Not measured.

CORDS AVAILABLE.—December 2, 1904, to September 30, 1916.

GE.—Original gage was vertical staff spiked to cribwork of right abutment on downstream side of bridge; a new gage installed April 17, 1907, at a different datum, was used during 1907 and 1908; records for 1909 to 1916 referred to the original gage, which is read by W. J. Auchard.

HARGE MEASUREMENTS.—Made from highway bridge or by wading.

ANNEL AND CONTROL.—Bed of stream gravel; no definite control. One channel at low and medium stages; at high stages water overflows right bank a quarter mile above the gage and there are two to four channels. Stage-discharge relation subject to change at high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.4 feet June 22 (discharge, 1,910 second-feet); minimum stage recorded, 2.5 feet December 19 (discharge measurement, 19 second-feet).

1905–1916: Maximum stage recorded, 6.2 feet June 2, 1908 (discharge, 4,300 second-feet); minimum "dry" July 28–30, 1910.

Ice.—Stage-discharge relation seriously affected by i. e.

Diversions.—Water diverted to irrigate valley lands both above and below station. During dry seasons the entire summer flow is utilized.

Regulation.—None. Melting snow in mountains causes small diurnal fluctuation during spring months.

Accuracy.—Stage-discharge relation not permanent; affected by shifting control. Gage read to half tenths once daily. Used three rating curves applicable as follows: October 1 to March 4, fairly well defined below 500 second-feet; March 5 to June 5, poorly defined; and June 6 to September 30, well defined between 50 and 1,600 second-feet. Discharge ascertained by applying daily gage height to rating tables. Records good.

Discharge measurements of South Fork of Sun River at Augusta, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 7	1.35	82	June 18	3.20	588	Aug. 11	2.25	118
Dec. 19[a]	2.50	19.2	25	3.85	1,250	Sept. 14	2.10	75
Apr. 20	1.82	177	July 12	3.00	417			

[a] Stage-discharge relation affected by backwater from dam across channel and ice.

Daily discharge, in second-feet, of South Fork of Sun River at Augusta, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	62	120	98	190	1,160	756	157	55
2	88	62	133	98	190	965	756	157	55
3	88	62	148	98	190	1,010	756	157	88
4	88	62	242	98	207	1,360	611	157	76
5	79	62	1,360	98	207	1,460	566	157	76
6	79	62	790	98	246	806	1,010	114	76
7	79	62	790	98	386	756	453	114	76
8	79	62	565	111	246	756	806	114	76
9	79	62	790	111	207	806	656	114	76
10	79	70	336	140	207	856	566	114	76
11	79	79	172	140	207	756	453	114	76
12	79	79	172	140	172	656	453	114	76
13	79	79	172	140	172	488	420	100	76
14	79	79	172	156	172	420	363	100	76
15	79	79	140	156	172	488	338	100	76
16	79	79	98	156	156	566	338	100	76
17	79	79	98	156	156	611	313	100	76
18	79	79	85	156	140	566	313	114	76
19	79	54	98	172	140	488	313	114	66
20	79	47	98	190	140	706	313	100	66
21	79	40	126	172	140	1,670	290	88	66
22	79	40	126	156	140	1,910	248	88	66
23	70	40	126	156	140	1,310	227	76	66
24	70	40	111	156	172	1,190	227	76	66
25	70	40	98	156	190	1,250	208	76	55
26	62	40	98	156	246	1,250	208	76	55
27	62	40	98	156	268	1,070	208	76	76
28	62	40	98	172	440	1,190	208	76	76
29	62	40	98	172	500	1,130	208	55	76
30	62	40	98	207	672	908	174	55	66
31	62	....	98	....	672	....	174	55	....

Note.—Discharge Nov. 14–17 interpolated on account of ice; Nov. 22–30 estimated at 40 second-feet.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	88	62	76.0	4,670
November	79	....	58.7	3,490
March	1,360	85	250	15,400
April	207	98	142	8,450
May	672	140	241	14,800
June	1,910	420	952	56,600
July	1,010	174	417	25,600
August	157	55	103	6,330
September	88	55	71.3	4,240

MARIAS RIVER BASIN.

TWO MEDICINE RIVER AT FAMILY, MONT.

Location.—In NE. ¼ sec. 2, T. 31 N., R. 9 W., at Holy Family Mission, in Teton County, 16 miles southeast of Browning and about 6 miles above mouth of Badger Creek, the nearest tributary.

Drainage area.—368 square miles.

Records available.—April, 1907, to September 30, 1916.

Gage.—Overhanging chain gage installed July 15, 1916, on left bank about 150 feet below barn belonging to Holy Family Mission; read by John Gobert. Datum of original gage, which was at same site as present gage, was lowered 0.95 foot July 21, 1908. Original chain gage and bench marks were destroyed by flood of June 2, 1913, and on June 10 a staff gage was installed at a different datum on left bank about 125 feet above site of chain gage. On July 23, 1913, this staff gage was removed to site of chain gage and was set to read 1.85 feet higher than staff gage installed June 10. Overhanging chain gage, installed September 18, 1913, was set to read 1.00 foot higher than staff gage installed July 23, 1913, and read to May 7, 1916, when destroyed by flood. Temporary gages at independent datum read May 16 to July 15, 1916, when present gage was installed.

Discharge measurements.—Made by wading near gage or from old wagon bridge about 3 miles above the mission.

Channel and control.—Gravel; shifting. Both banks high and not subject to overflow except at extreme floods.

Extremes of discharge.—Maximum stage recorded during year, 7.5 feet at 6 a. m. June 21 (discharge about 4,500 second-feet; gage height uncertain); minimum stage recorded, 1.45 feet December 18 and 19 (discharge, 44 second-feet); low flow may have occurred in January.

1907-1916: Maximum stage recorded, 8.15 feet June 9, 1909 (discharge, 7,600 second-feet); undoubtedly higher in June, 1908, but no record available, as gage washed out; minimum stage recorded, 1.3 feet January 12 to March 8, 1908 (discharge, 17 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversion.—Water diverted about 2 miles above gage by ditch which supplies about 100 acres on farm at the Holy Family Mission. From May 18 to September 8 a total diversion 5,824 acre-feet was made by the United States Reclamation Service above the station to irrigate lands in the vicinity of Seville on the Blackfeet Indian Reservation.

Regulation.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and seriously by ice. Rating curves used as follows: October to December 29, poorly defined; February 18 to May 7, fairly well defined; July 4 to September 30, fairly well defined below 1,100 second-feet. Gage read to quarter-tenths twice daily. No gage-height record May 8–15; record May 16 to July 13 questionable, as it was obtained from several gages set by observer at unknown datum, being washed away before their elevations were obtained. Discharge ascertained by applying mean daily gage heights to rating table except May 8 to July 3, which was determined from gage heights and by comparison with record for Badger Creek, using discharge measurements of May 19 and June 7. Gage read but data inadequate for determination of flow for period of ice effect. Records fair except those for period May 8 to July 3, which are poor.

Discharge measurements of Two Medicine River at Family, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. A. Lamb	2.37	179	June 7[b]	A. H. Tuttle	[c] 4.80	1,710
Jan. 26[a]	.....do	1.93	74	July 15[b]	W. A. Lamb	4.21	868
Mar. 10	.....do	3.36	447	Aug. 15	.....do	2.85	190
Apr. 28[b]	.....do	4.35	1,200	Sept. 18	.....do	2.74	146
May 19[b]	.....do	[c] 4.20	1,010				

[a] Stream frozen over at gage; ice cover about 2 inches thick. Control about one-third open in middle.
[b] Measured from wagon bridge 3 miles above gage.
[c] Gage height uncertain owing to changes in location and datum of gage.

Daily discharge, in second-feet, of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	205	263	138	....	140	382	860	1,430	2,000	274	149
2	205	263	129	....	196	364	820	1,440	2,000	256	160
3	218	263	158	....	236	346	900	1,400	1,960	225	184
4	232	247	138	....	209	364	1,470	1,500	1,900	225	184
5	205	218	129	....	196	312	1,990	2,040	1,760	197	420
6	232	331	138	....	161	329	2,280	1,740	1,580	197	471
7	263	296	138	....	150	364	2,280	1,710	1,530	211	471
8	263	296	138	....	161	463	2,000	1,760	1,440	172	396
9	263	263	158	....	209	534	1,750	1,950	1,440	211	330
10	247	232	129	....	678	509	1,500	2,100	1,440	240	352
11	218	218	120	....	1,020	1,140	1,150	1,950	1,350	256	291
12	232	192	138	....	1,390	820	1,000	1,770	1,260	256	256
13	247	169	104	....	940	588	900	1,740	1,180	240	225
14	263	129	120	....	236	820	800	1,650	1,090	240	240
15	263	148	97	....	560	1,060	750	2,000	891	197	197
16	263	180	78	....	486	900	712	2,240	852	211	197
17	247	180	66	....	509	746	746	2,040	779	172	172
18	205	158	44	980	509	712	900	2,260	710	197	184
19	218	158	44	1,140	509	712	1,140	2,150	614	197	149
20	247	279	72	560	382	616	1,140	4,240	526	225	149
21	232	180	90	463	940	616	1,220	4,300	471	225	149
22	232	158	78	382	678	678	1,140	4,080	373	197	149
23	232	169	104	442	534	486	980	2,890	373	211	128
24	232	205	78	312	486	509	940	1,980	330	197	128
25	205	148	72	364	421	647	1,020	1,980	310	172	128
26	218	138	104	250	442	860	900	1,950	291	172	128
27	247	138	120	280	312	1,100	1,160	1,950	310	172	128
28	232	148	104	222	296	1,340	1,410	2,000	291	172	149
29	232	138	104	121	486	1,020	1,510	2,050	330	184	160
30	218	129	97	....	421	900	1,350	2,050	225	172	160
31	218	....	90	....	421	....	1,410	....	256	160	....

Monthly discharge of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	263	205	233	14,300
November	331	129	201	12,000
December	158	44	107	6,580
February 18-29	1,140	121	460	10,900
March	1,390	140	462	28,400
April	1,340	312	675	40,200
May	2,280	712	1,230	75,600
June	4,300	1,400	2,140	127,000
July	2,000	225	963	59,200
August	274	160	208	12,800
September	471	128	219	13,000

MARIAS RIVER NEAR SHELBY, MONT.

Location.—In sec. 20, T. 31 N., R. 2 W., at highway bridge near James A. Johnson's ranch, 7 miles south of Shelby, in Toole County.

Drainage area.—2,610 square miles.

Records available.—April 4, 1902, to January 11, 1908; April 23, 1911, to September 30, 1916.

Gages.—Chain gage on downstream side of bridge. April 4, 1902, to January 11, 1908; chain gage on highway bridge, about 100 feet below present bridge; during 1911 and 1912 Bristol water-stage recorder; all gages at practically the same datum. Gage read by G. J. Moser.

Discharge measurements.—Made from downstream side of highway bridge.

Channel and control.—Gravel and boulders; shifts. Left bank steep and high; not subject to overflow. Right bank gently sloping; subject to overflow at extreme high stages.

Extremes of discharge.—Maximum stage recorded during year, 13.5 feet at 11 a. m. June 22 (discharge, determined from extension of rating curve, 15,600 second-feet); minimum stage recorded, 3.5 feet November 13 (discharge 370 second-feet).

1902–1907 and 1911–1916: Maximum stage recorded, 14.9 feet June 24, 1907 (discharge, 29,500 second-feet); minimum stage recorded, 1.7 feet November 16–20, 1904 (discharge, 150 second-feet).

Ice.—Stage-discharge relation affected by ice; observations discontinued during winter.

Diversions.—Water for Valier-Montana Land & Water Co.'s Cary project and for Blackfeet project of the United States Reclamation Service is diverted above this station; also a number of smaller diversions.

Regulation.—None.

Accuracy.—Stage discharge relation not permanent, affected by shifting control. Three rating curves used, applicable as follows: October 1 to November 14 fairly well defined for medium and low stages; March 15 to June 23 well defined below 3,650 second-feet and extended above that point; June 24 to September 30, poorly defined. Gage read to tenths once daily. Discharge ascertained by applying daily gage height to rating tables. Records good March 16 to June 23; fair for rest of year.

Discharge measurement of Marias River near Shelby, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 28	W. A. Lamb	4.98	2,220
May 26	A. H. Tuttle	4.95	2,240
July 14	W. A. Lamb	5.50	3,150

Daily discharge, in second-feet of Marias River near Shelby, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	581	581		935	1,780	2,790	6,780	1,160	1,700
2	581	581		1,120	1,440	2,930	6,630	1,160	1,590
3	518	581		1,120	1,660	2,930	5,790	1,060	1,480
4	581	581		1,020	1,900	4,590	5,510	1,060	1,260
5	518	616		1,020	2,790	4,750	4,950	960	960
6	650	650		1,020	3,500	4,750	4,530	960	870
7	581	581		1,120	3,210	3,950	4,250	1,060	700
8	518	581		1,120	2,270	3,210	4,530	870	700
9	650	650		1,120	1,780	2,790	4,390	870	780
10	518	650		1,120	1,550	2,400	4,250	780	700
11	581	518		1,120	1,440	3,800	3,830	700	780
12	518	462		1,120	1,440	4,110	3,550	870	700
13	581	370		1,440	1,550	8,650	3,410	960	620
14	581			1,330	1,660	3,800	3,130	960	620
15	581			1,220	1,550	3,950	3,130	960	620
16	581			1,330	1,550	4,110	2,990	960	620
17	581			1,440	1,440	4,110	2,710	870	700
18	518		1,120	1,440	1,550	5,400	2,710	870	620
19	581		1,440	1,330	1,660	5,570	2,580	870	620
20	650		1,440	1,220	1,780	6,630	2,450	870	550
21	650		1,440	1,120	1,780	9,620	2,190	870	550
22	581		1,550	1,120	1,900	15,600	2,060	780	620
23	650		1,660	1,120	2,140	14,000	1,940	780	620
24	650		1,660	1,220	2,140	9,460	1,940	780	550
25	650		1,660	1,220	2,270	8,500	1,820	780	550
26	581		1,220	1,220	2,270	7,540	1,700	780	620
27	518		1,220	1,330	2,270	7,540	1,590	780	620
28	518		1,120	2,140	2,270	7,380	1,590	960	550
29	581		1,120	2,270	2,400	7,230	1,370	1,260	550
30	581		1,120	1,660	2,660	7,230	1,260	1,480	550
31	518		1,020		2,660		1,260	1,700	

NOTE.—Gage read to Dec. 4, but data inadequate for determination of flow owing to effect of ice. Gage not read Dec. 5 to Mar. 17. Discharge, June 25, interpolated.

Monthly discharge of Marias River near Shelby, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	650	518	578	35,500
November 1-13	650	370	569	14,700
March 18–31	1,660	1,020	1,340	37,200
April	2,270	935	1,270	75,600
May	3,500	1,440	2,010	124,000
June	15,600	2,400	5,810	346,000
July	6,780	1,260	3,250	200,000
August	1,700	700	961	59,100
September	1,700	550	766	45,600

BADGER CREEK NEAR FAMILY, MONT.

ATION.—In NE. ¼ sec. 19, T. 31 N., R. 8 W., near road crossing 4 miles east of Family in Teton County.

AGE AREA.—224 square miles.

RDS AVAILABLE.—April 20, 1907, to September 30, 1916.

—Chain; read to May 13, 1916, by O. J. Racine, and thereafter by Mrs. Claudia ard. The original staff gage, established April 20, 1907, and bench marks, washed out in June, 1908, and a new gage was established July 22, 1908, about 40 feet farther upstream and at a different datum; as the bench mark was destroyed the relation between the two gages could not be determined. Gage was ain washed out May 25, 1909, and was reset at a different datum, on right bank, d 400 feet below old Piegan Mission crossing.

ARGE MEASUREMENTS.—Made from cable 4 miles above gage or by wading at d above gage.

EL AND CONTROL.—Slightly shifting; two channels at both medium and low stages; at high stages stream flows in several channels. Banks low and subject to erflow above gage.

EMES OF DISCHARGE.—Maximum stage recorded during year, 6.7 feet at 9 a. m. ne 21 (discharge, 1,650 second-feet); minimum open-water stage recorded, feet at 6.20 p. m. October 1 (discharge, 171 second-feet.)

1907-1916: Maximum stage recorded, 5.85 feet May 27, 1913 (discharge, 1,780 second-feet); minimum, 3.45 feet September 25, 28, and 30, 1914 (discharge, 92 second-feet); records for open-water season only; mean discharge for February, 1911 estimated at 25 second-feet.

—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

SIONS.—The United States Reclamation Service proposes to divert the natural w of Badger Creek to irrigate land in the eastern part of the Blackfeet Indian Reservation north of Birch Creek. A small amount of water was diverted in 1916 above the gage.

LATION.—None.

RACY.—Stage-discharge relation not permanent; affected by shifting control. Rating curves used applicable as follows: October 1 to December 1, and March 24 to May 7, fairly well defined; June 22 to September 30, well defined. Gage read to quarter tenths once daily until May 13 and twice daily thereafter. Discharge ascertained by applying mean daily gage height to rating tables; shifting-control method used May 8 to June 21. Records good.

rge measurements of Badger Creek near Family, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
[illegible]	[a] 4.90	602	Aug. 15	4.45	252
[illegible]	[a] 4.97	596	Sept. 18	4.31	180
[illegible]	[a] 5.09	613			

[a] Made by wading at ford 1 mile above gage.

Daily discharge, in second-feet, of Badger Creek, near Family, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	171	180	188	....	265	426	692	1,030	381	202
2	175	180	180	....	265	400	724	1,060	327	225
3	175	188	180	....	265	400	756	1,030	327	250
4	175	195	180	....	285	562	1,010	968	327	327
5	180	195	....	....	285	740	1,140	903	327	327
6	175	188	....	....	305	800	948	839	327	275
7	175	195	....	....	285	800	852	871	301	225
8	175	188	....	....	305	769	916	903	327	225
9	175	188	....	....	305	605	1,050	807	354	225
10	188	188	....	....	305	598	1,050	807	327	275
11	180	188	....	....	305	531	884	743	301	225
12	180	195	....	....	305	531	884	743	275	225
13	175	195	....	....	305	466	884	679	275	225
14	175	195	....	....	328	354	948	617	275	225
15	180	188	....	....	328	349	948	617	250	202
16	175	188	....	....	305	349	1,140	617	250	180
17	180	188	....	....	328	398	1,140	586	275	180
18	188	180	....	....	350	478	1,080	555	275	180
19	188	180	....	....	328	598	1,140	525	275	....
20	188	180	....	....	350	567	1,080	495	275	....
21	180	180	....	....	350	629	1,520	495	225	....
22	188	175	....	....	350	598	1,200	466	225	....
23	188	175	....	....	400	507	1,100	437	225	....
24	188	180	....	215	400	449	1,030	437	225	....
25	188	180	....	200	452	449	1,030	437	225	....
26	188	175	....	230	452	449	1,000	437	327	....
27	188	175	....	230	506	537	1,000	466	250	....
28	188	180	....	265	591	629	1,060	437	225	....
29	180	188	....	265	506	692	1,100	381	202	....
30	180	180	....	265	452	692	1,030	381	202	....
31	180	....	....	265	....	629	....	381	202	....

NOTE.—Discharge Dec. 2-4 estimated on account of backwater from ice; Sept. 17, interpolated.

Monthly discharge of Badger Creek near Family, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	188	171	181	11,100
November	195	175	185	11,000
December 1-4	188	180	182	1,440
March 24-31	265	200	242	3,840
April	591	265	352	20,900
May	800	349	548	33,700
June	1,520	692	1,010	60,100
July	1,060	381	650	40,000
August	381	202	277	17,000
September 1-18	327	180	233	8,320

BIRCH CREEK AT SWIFT DAM, NEAR DUPUYER, MONT.

LOCATION.—At Swift dam, on south boundary of Blackfeet Indian Reservation, Teton County, about 20 miles west of Dupuyer and 34 miles west of Valier. North and south forks of Birch Creek unite in reservoir above station.

DRAINAGE AREA.—About 120 square miles.

RECORDS AVAILABLE.—March 26, 1913, to September 30, 1916.

GAGES.—Vertical iron staff on right bank, about 800 feet below dam, used for determining flow through valves in dam. Discharge over spillway determined from readings of inclined staff gage near lower end and on left side of spillway channel. Gages read by H. C. Stalzer. Prior to July 11, 1915, a vertical wooden staff on right bank, one-fourth mile below dam, was used for all readings except June 5 to July 16, 1913, when a vertical staff on left bank immediately below dam was read to obtain high-water records.

Discharge measurements.—Discharge through valves measured by wading at gage or from foot bridge about 300 feet above gage. Spillway discharge determined by wading on lip of spillway, from foot bridge, or by floats near gage.

Channel and control.—Bed of channel conveying flow from valves clean, coarse gravel and boulders. Right bank at gage high and not subject to overflow; left bank high and subject to overflow only if floods should break across from spillway channel and flow into this one; right bank subject to overflow about 200 feet below gage during high water. Control for discharge below 500 second-feet is riffle about 100 feet below gage, which has not shifted since gage was located at present site.

Spillway channel, cement-lined channel ending at solid limestone ledge which is crest of falls. Not liable to change.

Extremes of discharge.—Maximum stage (for flow from valves) recorded during year, 3.45 feet at 8 a. m. and 6 p. m. June 21, and at 8 a. m. June 22 (discharge 565 second-feet); maximum stage (from spillway) recorded during year, 12.94 feet at 5 a. m. June 21 (discharge 4,710 second-feet). Combined maximum discharge 5,275 second-feet. Minimum stage, 1.52 feet at 12.20 p. m. December 11, and at 8 a. m. and 5.30 p. m. December 12 (discharge 5 second-feet).

1913–1916: Maximum discharge 5,275 second-feet at 5 a. m. June 21, 1916; minimum discharge 0.9 second-foot March 6, 1915.

Ice.—The presence of ice seldom affects the winter flow at this station.

Diversions.—Two small irrigation ditches divert between station and dam. Acre-feet in storage at end of each month was as follows: September (1915) 26,670, October, 24,350; November, 24,635; December, 25,040; January, 25,770; February; 25,080; March, 13,550; April, 13,860; May, 20,960; June 30,120; July, 26,750; August, 17,720; September, 7,060.

Regulation.—Dam is used to store flood and winter flow, and during dry periods will release no more water than is required by the canal system of the Valier Carey project in addition to amount required by prior rights.

Determination of discharge.—Discharge through valves in mouth of tunnel at south end of dam flows down main channel of creek past the vertical iron staff gage on right bank. Readings from this gage indicate flow through valves not diverted between dam and gage. Flow over spillway passes down artificial channel and joins creek about one-fourth mile below dam. Readings from inclined gage near lower end of this channel indicate total flow from reservoir not passing through valves. Total mean daily discharge obtained by adding flow passing the two gages.

Accuracy.—Stage-discharge relation permanent for both gages. Rating curve for gage in channel conveying flow from valves well defined; for gage in spillway channel fairly-well defined below 3,000 second-feet and approximate above 3,000 second-feet. Gage in channel from valves read to hundredths twice daily. Gage in spillway channel read to tenths twice daily except June 16–17 and 20–24, when from 3 to 10 readings were taken daily. Daily discharge for channel from valves ascertained by applying to rating table mean daily gage heights obtained by weighting observed gage heights according to observer's notes for days on which gate openings were changed; daily discharge for spillway channel ascertained by applying mean daily gage height to rating table except for June 16–17 and 20–24, when the mean discharge between two consecutive readings was applied to the time interval between those readings. Records of flow through valves good; for spillway channel fair except June 21, for which computed discharge is roughly approximate.

Cooperation.—Record of gage heights furnished and most of discharge measurements made by engineering department of the Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek, showing flow through valves at Swift dam, near Dupuyer, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	Chadwick [a] and Himmelstein [a]	2.50	118	Apr. 20	Chadwick and Atwood	2.10	59
Nov. 4	Heidel and Atwood [a]	2.15	64	May 9	Heidel and Atwood	2.69	178
Dec. 11	H. M. Chadwick	1.52	4.9	June 2	Atwood and Hall [a]	3.15	374
Feb. 17	Chadwick and Atwood	2.57	139	17	Atwood and Chadwick	3.35	495
Apr. 8	Atwood and Himmelstein	2.89	241	July 1	Heidel and Atwood	3.35	487
				30	Atwood and Sage [a]	3.18	328
				Aug. 31	Heidel and Atwood	3.00	281

[a] Employee of Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek, showing flow over spillway at Swift dam, near Dupuyer, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
June 17	Atwood and Chadwick [a]	2.90	[b] 591	June 23	Atwood and Stalzer [a]	4.80	[c] 1,160
21	Chadwick and Hall [a]	12.44	[c] [d] 4,620	24	Atwood and Chadwick	4.30	998
21	Atwood and Chadwick	10.44	[c] [e] 3,480	July 1	Heidel and Atwood	2.30	461
				18	Atwood and Stalzer	.15	[c] 2.6

[a] Employee of Valier-Montana Land & Water Co.

[b] Measured by wading on lip of spillway.

[c] Float measurement.

[d] Discharge obtained by assuming flow in concrete-lined portion of the section to be the same as though running full and applying a coefficient of 0.6 to the maximum float velocity of 25 feet per second to obtain velocity of section above the concrete.

[e] A coefficient of 0.6 was applied to the maximum float velocity of 20 feet per second and discharge obtained as noted for first measurement of this date.

Daily discharge, in second-feet, of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	95	63	57	110	275	263	159	360	963	365	286
2	124	77	61	57	79	275	263	175	360	1,010	360	286
3	124	64	63	57	57	275	263	175	360	981	360	286
4	124	64	63	57	57	275	263	175	360	874	360	286
5	124	63	63	57	57	275	263	175	360	667	360	286
6	121	63	63	55	57	275	256	173	360	632	365	286
7	124	63	63	79	64	275	252	175	420	623	376	286
8	138	63	61	71	64	291	248	175	426	676	376	286
9	187	63	63	71	64	309	216	175	605	703	365	286
10	187	64	54	71	57	309	130	175	605	609	360	286
11	210	64	5	68	57	309	52	173	605	599	360	286
12	248	63	5	57	67	309	52	175	605	590	360	286
13	248	64	9	57	96	309	55	175	526	558	376	286
14	244	63	15	57	106	286	57	175	511	506	376	282
15	244	63	32	57	108	286	57	173	489	501	365	278
16	241	68	46	57	124	286	57	173	645	497	360	278
17	241	63	55	57	140	286	64	173	1,070	493	360	278
18	241	68	57	57	213	286	63	173	1,130	489	360	278
19	244	63	57	57	230	286	60	173	1,160	421	365	278
20	241	63	57	64	230	286	58	175	2,500	388	376	278
21	241	63	57	64	230	282	64	175	4,620	388	376	278
22	241	63	57	64	248	278	87	175	2,620	360	365	278
23	238	63	57	60	267	278	87	181	1,780	332	360	275
24	200	63	57	57	267	275	87	181	1,530	332	343	275
25	167	61	57	110	271	271	87	181	1,430	343	332	275
26	148	61	57	117	275	271	98	181	1,380	343	309	275
27	115	61	57	117	275	271	128	194	1,330	332	309	271
28	96	61	57	110	275	271	136	323	1,300	343	309	267
29	95	61	57	106	275	263	146	360	1,270	360	309	267
30	95	61	57	106	....	263	153	360	988	360	295	267
31	95	....	57	117	....	263	....	360	....	365	286	....

NOTE.—The above table shows total flow through valves and over spillway. There was no flow over spillway except during period June 13 to July 22.

Monthly discharge of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	248	95	178	10,900
November	95	61	64.3	3,830
December	63	5	51.0	3,140
January	117	55	72.5	4,460
February	275	57	152	8,740
March	309	263	282	17,300
April	263	52	136	8,090
May	360	159	198	12,200
June	4,620	360	1,060	63,100
July	1,010	332	537	33,000
August	376	286	352	21,600
September	286	267	280	16,700
The year	4,620	5	279	203,000

Note.—The above table shows total flow through valves and over spillway.

BIRCH CREEK NEAR DUPUYER, MONT.

Location.—In sec. 28, T. 29 N., R. 8 W., at Kepple's ranch, about half a mile above headgates of B canal of Valier-Montana Land & Water Co., 12 miles northwest of Dupuyer, Teton County, and about 20 miles above mouth of Dupuyer Creek.

Drainage area.—About 155 square miles (measured on Land Office map).

Records available.—July 25, 1907, to September 30, 1916.

Gage.—Inclined staff on right bank, nearly one-half mile due west of the ranch buildings; read until December 31, 1915; beginning January 1, 1916, a vertical 1-inch square steel bar, marked to tenths, about 1,000 feet downstream, was used but this was washed out June 21; observer set a temporary gage at approximately the same location June 23, which was replaced by new vertical steel staff at same section July 5 and referred to approximately the same datum. Read by John Ryan. Gage previously used as follows: A chain gage on right bank about 250 feet below inclined staff July 25, 1907, until June, 1908, when it was washed out; a temporary staff 200 feet below old chain gage July 23 to October 1, 1908, when a new chain gage was installed on right bank one-fourth mile above old site; chain gage used until December 31, 1913; inclined staff with datum unchanged January 1, 1914, to December 31, 1915. No relation determined between gage datums for the different sections.

Discharge measurements.—Made by wading or from cable. Cable originally was established about 100 feet below inclined gage but was moved downstream to 75 feet below new vertical steel staff; washed out June 21, 1916.

Channel and control.—Rock and gravel at inclined gage. Principal control is riffle about 100 feet below; shifting. Large clean gravel at site of present gage; control is gravel bar about 250 feet below gage. Banks of medium height, covered with brush, and subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 10.0 feet June 21, determined by leveling from high-water marks (discharge estimated 5,000 second-feet by comparison with flow at Swift dam); minimum discharge during open-water period 80 second-feet November 5–8 and April 19 and 21.

1907–1916: Maximum stage recorded, 10.0 feet June 21, 1916 (discharge estimated 5,000 second-feet); minimum discharge, 7 second-feet, April 21–30, 1915.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Two or three small ditches divert above station.

Regulation.—The flow is largely controlled by Swift dam at the Birch Creek reservoir with a storage capacity of 30,000 acre-feet; about 12 miles upstream from station.

ACCURACY.—Stage-discharge relation fairly permanent at old site October 1 to November 10; affected by ice November 11 to February 22; practically unchanged at new location December 7 to June 18; changing after June 18. Rating curves used October 1 to November 10 and February 23 to June 9 well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating tables, except June 10 to July 4, which was estimated by comparison with records of flow at Swift dam and July 5 to September 30, which was obtained by shifting-control method. Gage read but data inadequate to warrant determinations of flow for period of ice effect. Results obtained by the use of rating tables, good; other results fair.

Discharge measurements of Birch Creek near Dupuyer, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	McHugh[a] and Atwood[a]	3.77	252	June 9	Chadwick and Spier[a]	4.75	448
Nov. 4	Heidel and Atwood	3.27	83	18	Atwood and Himmelstein[a]	5.84	1,090
Dec. 7	Chadwick[a] and Larson[a]	[b] 3.53	74				
Mar. 28	Chadwick and Minkler[a]	[c] 4.40	296	Aug. 30	Atwood and Heidel	4.69	319
May 9	Heidel and Atwood	4.10	194				

[a] Employee of engineering department of the Valier-Montana Land & Water Co.
[b] Gage height obtained from new gage; old gage read 3.48 feet.
[c] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	117	104	....	293	293	143	446	1,130	442	313
2	120	104	....	353	293	167	446	1,160	437	320
3	120	104	....	332	293	167	446	1,130	428	340
4	117	84	....	328	290	167	437	1,020	418	320
5	120	80	....	316	290	170	446	880	416	320
6	123	80	....	293	290	175	461	816	416	316
7	120	80	....	293	290	181	461	816	414	309
8	120	80	....	293	279	189	470	874	418	313
9	143	82	....	301	279	195	508	874	418	305
10	157	84	....	332	102	195	670	874	428	297
11	157	....	....	305	90	195	670	804	414	297
12	236	....	....	332	85	195	670	749	410	297
13	236	....	....	332	85	195	630	691	400	293
14	240	....	....	332	84	195	570	685	387	293
15	240	....	....	313	84	195	550	685	387	297
16	240	....	....	309	84	195	710	685	387	297
17	240	....	....	309	82	195	1,100	669	382	286
18	244	....	....	313	82	195	1,150	658	382	286
19	244	....	....	313	80	189	1,200	658	382	283
20	244	....	....	313	78	189	2,600	652	382	272
21	244	....	....	313	80	181	5,000	652	378	272
22	244	....	....	313	85	181	3,000	625	378	268
23	244	....	642	309	85	181	2,350	499	374	264
24	244	....	374	305	85	201	1,680	451	374	264
25	244	....	301	293	85	227	1,580	451	374	264
26	153	....	293	293	85	244	1,530	470	374	264
27	128	....	293	293	121	279	1,480	470	365	264
28	107	....	332	293	123	279	1,450	451	365	264
29	107	....	293	297	123	357	1,420	446	357	264
30	104	....	....	297	133	423	1,130	446	320	264
31	104	....	....	293	....	423	....	446	313	....

Monthly discharge of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	244	104	177	10,900
November 1-10	104	80	88.2	1,750
February 23-29	642	293	361	5,010
March	353	293	310	19,100
April	293	78	151	8,980
May	423	143	215	13,200
June	[a] 5,000	437	1,180	70,200
July	1,160	446	707	43,500
August	442	313	391	24,000
September	340	264	290	17,300

[a] Estimated by comparison with record obtained at Swift Dam.

BIRCH CREEK AT NELSON'S RANCH, NEAR DUPUYER, MONT.

Location.—In NW. ¼ sec. 27, T. 29 N., R. 8 W., a quarter of a mile below headworks of B canal of Valier Carey project, at Nelson's ranch, 11 miles northwest of Dupuyer, in Teton County.

Drainage area.—Not measured.

Records available.—May 8, 1914, to September 30, 1916.

Gage.—Vertical iron staff on right bank a short distance above the ranch building; read since July 1, 1916. The inclined wooden staff at same location and datum used prior to June 18, 1916 was destroyed by flood June 19-21, 1916. Gage read by John Ryan.

Discharge measurements.—Made by wading 100 feet above gage.

Channel and control.—Bed composed of cobblestones and gravel; shifts at extreme floods. Channel occasionally obstructed by growth of aquatic plants in summer.

Extremes of discharge.—Maximum stage recorded during year, 5.10 feet July 2 (discharge 930 second-feet); minimum stage recorded was 2.15 feet December 21, 1915. Stage-discharge relation affected by ice.

1914–1916: Maximum stage occurred June 19-21, 1916, after gage was washed away (stage and discharge unknown); maximum stage recorded 5.10 feet July 2, 1916 (discharge 930 second-feet); minimum stage 1.67 feet (or less) October 18–24, 1914, March 28 to April 5 and April 8–30, 1915 (discharge, 0 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—The "B" canal and several small ditches divert water above station.

Regulation.—Except during floods the discharge is controlled by Swift dam and by the headworks of B canal.

Accuracy.—Stage-discharge relation changed during flood of June 19-21; affected by ice November 11 to February 24; fairly permanent at other times. Rating curve used October 1 to November 10 and February 25 to June 18 well defined between 107 and 250 second-feet; curve used July 1 to September 30 well defined between 25 and 350 second-feet. Gage read to hundredths once daily. Discharge ascertained by applying daily gage height to rating table. Gage read but data insufficient for determinations of flow during period of ice effect. Records below 400 second-feet good; above that, fair.

Cooperation.—Gage heights and some discharge measurements furnished by the engineering department of the Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Nelson's ranch near Dupuyer, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	McHugh[a] and Atwood[a]	3.10	209	Feb. 16	Chadwick and Atwood.	[b] 5.13	205
Nov. 3	Heidel and Atwood....	2.65	96	May 3	Heidel and Himmelstein[a]..............	2.85	136
Dec. 7	Chadwick[a] and Larson[a]................	[b] 2.69	77	Aug. 30	Atwood and Heidel....	3.90	292

[a] Employee of engineering department of Valier-Montana Land & Water Co.
[b] Stage-discharge relation seriously affected by ice.

Daily discharge, in second-feet, of Birch Creek at Nelson's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	76		282	286	146	423	875	336	280
2	43	76		290	282	178	423	930	336	285
3	44	94		301	282	140	423	902	336	312
4	42	73		290	275	140	414	765	336	289
5	43	71		286	275	146	423	710	336	289
6	44	71		275	275	153	431	655	336	289
7	94	71		275	275	156	431	655	336	280
8	94	71		275	264	156	423	710	336	280
9	118	73		290	264	156	452	710	336	274
10	130	74		309	107	156	479	710	336	268
11	130			309	94	159	501	655	336	268
12	206			328	85	162	501	600	336	268
13	210			309	78	162	501	572	327	268
14	216			309	78	162	501	572	312	268
15	216			301	78	162	501	572	312	268
16	216			297	76	194	501	572	308	268
17	216			297	74	203	795	562	298	259
18	219			301	74	208	843	545	294	259
19	219			301	73	197		545	294	255
20	219			301	71	197		545	289	255
21	219			301	78	197		545	289	255
22	216			301	85	197		545	289	255
23	216			297	85	197		386	289	255
24	216			294	85	184		336	289	255
25	216		286	290	85	197		336	289	255
26	146		257	290	85	213		336	289	255
27	107		275	290	118	243		336	289	255
28	80		301	290	121	243		336	289	255
29	80		290	290	121	332		336	289	255
30	78			290	134	393		336	285	255
31	76			286		402		336	280	

NOTE.—Gage not read; discharge interpolated Apr. 30, July 9, Aug. 5, 6, and Sept. 9.

Monthly discharge of Birch Creek at Nelson's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	219	42	142	8,730
November 1-10	94	71	75.0	1,490
February 25-29	301	257	282	2,800
March	328	275	295	18,100
April	286	71	145	8,630
May	402	140	198	12,200
June 1-18	843	414	498	17,800
July	930	336	565	34,700
August	336	280	311	19,100
September	312	255	268	15,900

BIRCH CREEK AT HALL'S RANCH, NEAR DUPUYER, MONT.

Location.—In NW. ¼ sec. 12, T. 29 N., R. 8 W., at Hall's ranch, about 4 miles below headworks of B canal of Valier Carey project and about 10 miles northwest of Dupuyer, Teton County.

Drainage area.—Not measured.

Records available.—May 16, 1913, to June 16, 1916.

Gage.—Vertical staff on left bank about 400 feet below a ford leading to ranch buildings, which are one-half mile away; read by Radford Angell. Gage used prior to June 27, 1915, a vertical staff on left bank about 400 feet below present site, referred to a different datum and was abandoned because of variable amount of backwater due to operation of an irrigation ditch.

Discharge measurements.—Made by wading.

Channel and control.—At ordinary stages a bar or ridge producing riffle about 100 feet below the new gage is principal control.

Extremes of discharge.—Maximum stage recorded during year, 2.55 feet June 16 (discharge, 536 second-feet); minimum stage, 0.98 foot December 17–18 (stage-discharge relation affected by ice; flow not computed).

1913–1916: Maximum stage recorded, 3.3 feet (old gage) May 28, 1913 (discharge, 910 second-feet); minimum stage, 0.10 foot (old gage) May 3, 1914 (discharge, 1.0 second-foot.)

Ice.—Stage-discharge relation seriously affected by ice after November 10; data insufficient to warrant estimates of flow.

Diversions.—A large part of the flow is diverted above the station.

Regulation.—Except during flood stages the discharge is controlled by Swift dam and the headworks of B canal.

Accuracy.—Stage-discharge relation not permanent; affected by ice and by shift in control. Rating curve used October 1 to November 10 well defined; curve used May 3 to June 16, poorly defined. Gage read once daily to hundredths. Discharge ascertained by applying daily gage heights to rating table. Gage read but data inadequate for determination of flow for period of ice effect. No record February 15 to May 2 and June 17 to September 30. Records October 1 to November 10 good; May 3 to June 16 poor.

Cooperation.—Gage heights and discharge measurements furnished by engineering department of Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Hall's ranch, near Dupuyer, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	McHugh[a] and Atwood[a].	1.99	206	Dec. 6	Chadwick[a] and Larson[a]	1.51	72
Nov. 3	Heidel and Atwood....	1.65	94	May 3	Heidel and Himmelstein[a]................	1.78	149
Dec. 1	Chadwick[a] and Larson[a]	[b] 1.78	75				

[a] Employee of engineering department of Valier-Montana Land & Water Co.

[b] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Birch Creek at Hall's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	Day.	Oct.	Nov.	May.	June.
1	50	83		400	16	202		159	536
2	50	83		412	17	210		203	
3	52	94	149	423	18	206		194	
4	50	79	152	435	19	210		194	
5	54	77	155	446	20	210		194	
6	54	74	155	446	21	210		194	
7	92	74	163	435	22	210		194	
8	92	74	159	476	23	206		194	
9	112	74	159	446	24	206		171	
10	120	74	163	505	25	202		220	
11	117		163	505	26	144		228	
12	190		167	511	27	114		233	
13	198		163	523	28	90		256	
14	198		167	505	29	83		325	
15	202		163	505	30	83		400	
					31	81		389	

Monthly discharge of Birch Creek at Hall's ranch, near Dupuyer, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	210	50	139	8,550
November 1-10	94	74	78.6	1,560
May 3-31	400	149	201	11,600
June 1-16	536	400	469	14,900

BIRCH CREEK AT ROBARE, MONT.

Location.—In N. ½ sec. 31, T. 30 N., R. 7 W., near former post office of Robare, 10 miles north of Dupuyer and 14 miles west of Valier, in Teton County.

Drainage area.—Not measured.

Records available.—June 4, 1914, to September 30, 1916.

Gage.—Inclined staff gage on right bank one-half mile downstream from old post office at Robare; read by Radford Angell. Vertical steel staff graduated to tenths set July 1, 1916, for high water.

Discharge measurements.—Made by wading.

Channel and control.—Bed of stream is composed of cobblestones and is fairly permanent. Stream flows in two channels at high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.11 feet June 17 (discharge, 1,010 second-feet); minimum stage recorded, 2.36 feet October 1 and 2 (discharge, 37 second-feet).

1914–1916: Maximum stage recorded, 4.11 feet June 17, 1916 (discharge, 1,010 second-feet); minimum stage, 1.64 feet May 11, 1915 (discharge, 0.4 second-feet).

Ice.—Stage-discharge relation affected by ice from November 30 to March 12.

Diversions.—Most of the water at ordinary stages is diverted or stored above the station.

Regulation.—Discharge largely controlled by operation of Swift dam, the B canal headworks, and several smaller ditches.

Accuracy.—Stage-discharge relation changed during the high water of June 18. The rating curves are fairly well defined except at high stages. Gage read to hundredths once daily. Daily discharge obtained by applying daily gage heights to rating table. Gage read but data inadequate to warrant computation of flow for period of ice effect. Results good.

Cooperation.—Discharge measurements and gage heights furnished by engineering department of Valier-Montana Land & Water Co.

Discharge measurements of Birch Creek at Robare, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	McHugh[a] and Atwood[a]	3.10	177	Dec. 6	Chadwick[a] and Larson[a]	2.60	61
Nov. 3	Heidel and Atwood	2.70	87	Mar. 28	Chadwick and Minkler[a]	3.27	251

[a] Employee of engineering department of Valier-Montana Land & Water Co.

Daily discharge, in second-feet, of Birch Creek at Robare, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	80		251	118	334	745	314	297
2	37	69		242	137	341	770	306	297
3	42	91		238	120	348	736	301	327
4	39	73		228	120	360	845	297	297
5	42	72		224	122	367	815	297	297
6	42	59		224	125	374	790	301	289
7	75	75		228	129	360	785	301	285
8	89	81		228	124	402	805	297	289
9	114	69		220	129	380	790	314	293
10	162	69		98	127	425	790	318	297
11	116	109		85	129	432	745	297	293
12	168	109		78	132	425	452	306	293
13	171	85	388	73	129	440	452	306	297
14	174	75	322	70	132	440	444	297	289
15	174	66	322	70	134	440	444	297	289
16	177	77	354	70	132	455	452	297	281
17	184	75	354	72	156	1,010	520	293	285
18	184	69	266	67	156		466	293	285
19	184	69	242	67	156		448	297	285
20	187	92	266	66	159		439	297	276
21	187	92	266	64	162		430	301	268
22	184	92	251	77	153		439	297	268
23	184	89	242	77	145		349	293	264
24	184	77	251	77	127		340	289	264
25	187	92	242	75	132		318	289	268
26	137	85	242	77	174		331	297	264
27	116	85	242	98	171		327	297	268
28	85	69	246	109	184		323	297	268
29	81	69	256	114	251		314	293	264
30	78		246	114	322		318	293	264
31	78		238		322		310	293	

NOTE.—Gage out June 18-30. Discharge not determined.

Monthly discharge of Birch Creek at Robare, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	187	37	126	7,750
November 1-29	109	59	79.8	4,590
March 13-31	388	238	276	10,400
April	251	64	126	7,500
May	322	118	155	9,530
June 1-17	1,010	334	431	14,500
July	845	310	533	32,800
August	318	289	299	18,400
September	327	264	283	16,800

DUPUYER CREEK NEAR VALIER, MONT.

Location.—In NE. ¼ NW. ¼ sec. 33, T. 29 N., R. 6 W., at Cowell ranch, 1,000 feet above diversion dam at head of D canal from Dupuyer Creek to Lake Frances reservoir and outlet of B canal, which diverts water from Birch Creek to Dupuyer Creek; about 6 miles below mouth of Sheep Creek and 11 miles southwest of Valier, Teton County, the nearest railway point.

Drainage area.—Not measured.

Records available.—July 17, 1912, to September 30, 1916.

Gage.—Vertical steel staff on right bank, 1,000 feet above diversion dam, since June 23, 1916; read by E. D. Perkins. An overhanging chain gage was used to May 15, 1913; a vertical wooden staff May 16, 1913, to April 1, 1914; an inclined wooden staff April 2, 1914, to March 12, 1915; and a vertical steel staff March 13, 1915, to February 17, 1916, when it was bent over by ice. The inclined wooden staff was read until a new vertical steel staff was set March 24, which was read until both it and the inclined wooden staff were washed out on June 21; datum unchanged; all gages at same site. A Bristol water-stage recorder was installed, but has not been used since 1912, and the well was completely washed out June 21, 1916.

Discharge measurements.—Made by wading at low stages. High-water measurements made by floats, or from bridge 5 miles below gage. Cable 30 feet below gage has not been repaired since support on right bank was undermined June 21. Measuring section obstructed during the late summer and fall by growth of algae.

Channel and control.—Bed of stream coarse gravel; right bank high and steep; left slopes gradually and is overflowed only at flood stage. A bar or ledge that produces a riffle about 400 feet below the gage forms the cotrol at certain stages.

Extremes of discharge.—Maximum stage recorded during year 6.5 feet on June 21, determined by level from flood marks (discharge 2,180 second-feet); minimum stage 2.64 feet November 6 (discharge 27 second-feet).

1912–1916: Maximum stage recorded 6.5 feet June 21, 1916, determined by level from flood marks (discharge 2,180 second-feet); minimum stage 2.22 feet August 9, 1914 (discharge 4.4 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—A number of small ditches divert water for irrigation from Dupuyer Creek and tributaries; many of the numerous water-right filings have been perfected by use.

Regulation.—None.

Accuracy.—Stage-discharge relation changed by high water of June 21–22; affected by ice November 10 to March 17. Rating curve used to June 20 well defined; curve used after that date well defined between 50 and 1,800 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating tables. Data inadequate for determination of discharge during period of ice effect. Records good.

Cooperation.—Gage heights and most of discharge measurements furnished by engineering department of Valier-Montana Land & Water Co.

measurements of Dupuyer Creek near Valier, Mont., during the year ending Sept. 30, 1916.

	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec-ft.*
	McHughs[a] and Atwood[a]	2.79	41.2	June 23	Chadwick and Himmelstein[a]	5.95	1,680
	Heidel and Atwood	2.75	37.7	30	Heidel and Chadwick	4.99	[d]890
	H. M. Chadwick[a]	[b]3.28	45.1	July 5	Heidel and Atwood	4.15	401
	Atwood and Chadwick	[b]5.27	[c]247	17	H. M. Chadwick	3.55	181
	H. M. Chadwick	2.95	57	29	do	3.31	123
	Atwood and Heidel	2.92	61	Aug. 28	Heidel and Atwood	2.96	59
	H. M. Chadwick	3.56	227				
	do	3.65	244				

ployee of engineering department, Valier-Montana Land & Water Co.

ischarge relation affected by ice.

asurement of water flowing over ice which was 3 feet thick. Water under ice could not be measured.

second-feet measured from steel bridge 5 miles below gage; 46 second-feet was being diverted by Canal.

ischarge, in second-feet, of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	56	42	....	60	65	214	638	115	55
	49	38	....	56	73	222	552	110	65
	49	39	....	59	70	214	525	104	85
	49	32	....	56	65	234	452	100	133
	50	38	....	53	70	315	406	92	81
	49	27	....	62	77	355	362	90	71
	56	32	....	57	73	315	340	85	68
	54	33	....	59	92	278	500	85	61
	56	44	....	59	82	278	452	143	62
	57	....	....	57	79	315	340	135	05
	54	....	....	52	75	234	282	110	58
	50	....	....	57	75	234	246	98	55
	50	....	....	57	71	202	228	90	58
	54	....	....	59	70	202	213	85	65
	56	....	....	59	70	198	198	78	58
	53	....	....	59	71	234	184	73	57
	53	....	....	54	71	234	184	73	56
	47	....	109	57	65	234	228	119	52
	44	....	109	57	62	234	173	85	50
	38	....	90	57	57	256	178	73	50
	49	....	94	56	68	2,180	165	68	48
	44	....	82	54	65	1,950	150	67	47
	44	....	73	56	59	1,720	145	64	45
	47	....	65	58	70	1,130	145	60	47
	44	....	92	49	82	898	126	61	45
	44	....	125	49	102	762	140	90	44
	44	....	113	54	210	730	150	73	48
	38	....	73	57	315	1,210	143	62	50
	38	....	82	65	278	1,210	123	68	47
	44	....	56	68	234	898	121	58	45
	45	....	65	....	214	....	117	56	....

—Discharge, June 22, interpolated.

hly discharge of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
er	57	38	48.5	2,980
mber 1-9	44	27	36.1	644
h 15-31	125	56	87.7	2,440
	68	49	56.9	3,390
	315	57	101	6,210
	2,180	198	590	35,100
	638	117	265	16,300
	143	56	86.1	5,290
er	133	44	59.0	3,510

CUT BANK CREEK AT CUT BANK, MONT.

Location.—In SW. ¼ SW. ¼ sec. 1, T. 33 N., R. 6 W., at Great Northern Railway bridge 12 miles above junction with Two Medicine River, half a mile west of Cut Bank, in Toole County.

Drainage area.—971 square miles.

Records available.—August 4, 1905, to September 30, 1916.

Gage.—Vertical staff nailed to pier protecting left bank of creek about 10 feet upstream from center line of Great Northern Railway bridge; used since August 31, 1911; prior to that date, a chain gage on left bank about 200 yards farther downstream. Read by Charles Ferres and Mrs. F. W. Allison.

Discharge measurements.—Made from highway bridge one quarter mile below gage or by wading.

Channel and control.—Rock and gravel bar about 200 feet below gage forms principal control; shifts only slightly. At high stages creek is 200 to 300 feet wide, but at low stages narrows at principal control.

Extremes of discharge.—Maximum stage recorded during year, 6.65 feet at 6 p. m. June 22 (discharge, 1,760 second-feet); minimum stage recorded, 4.10 feet September 29 (discharge, 51 second-feet).

1905–1916: Maximum stage recorded, 10.0 feet June 5, 1908 (discharge computed from extension of rating curve, 8,810 second-feet); minimum, 2.5 feet November 29, 30, 1905 (discharge, 5 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Intake of the Great Northern Railway's pumping station is 100 feet below gage; average quantity pumped is about 14,000 gallons an hour for 18 hours a day, equivalent to a continuous flow of 0.4 second-foot. There are also some small diversions for irrigation on the Blackfeet Indian Reservation above gage.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curves used October 1 to November 10, March 14 to May 8, and July 22 to September 30, well defined. Gage read to quarter tenths twice daily. Discharge ascertained by applying to rating table mean daily gage height except November 11–30, for which it was estimated from flow on November 10 and the discharge measurement November 29; discharge May 9 to July 21 determined by shifting-control method. Records good for periods for which rating tables were used; fair for other periods.

Discharge measurements of Cut Bank Creek at Cut Bank, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 29	W. A. Lamb	[a] 4.45	33	June 13	A. H. Tuttle	5.05	636
Jan. 27	.....do	[b] 5.50	5.1	July 14	W. A. Lamb	4.96	466
Mar. 14	.....do	5.18	576	Aug. 14	....do	4.43	152
May 20	.....do	4.66	309	Sept. 15	.....do	4.34	124

[a] Measurement made from ice cover 300 feet below gage; ice about 0.6 foot thick.

[b] Stage-discharge relation seriously affected by ice; ice about 2.0 feet thick. Temperature, 42° below zero.

arge, in second-feet, of Cut Bank Creek at Cut Bank, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	79	97		133	230	496	992	174	103
	79	97		162	230	470	912	149	122
	97	97		140	221	438	824	140	133
	97	97		122	192	502	824	133	206
	103	97		122	272	508	816	122	192
	97	97		103	400	721	816	122	174
	88	103		103	463	654	729	110	192
	79	97		103	528	515	654	103	221
	79	88		122	463	548	646	206	240
	97	103		140	376	736	610	221	230
	103	99		162	345	776	569	221	206
	97	96		183	293	668	569	221	183
	79	92		221	288	632	496	206	149
	79	88	596	221	261	668	457	183	133
	79	84	432	174	256	661	425	183	110
	88	80	432	183	251	816	388	162	103
	97	76	339	174	240	968	357	149	103
	97	72	282	174	246	1,010	351	140	88
	97	68	256	192	266	1,040	322	133	88
	110	64	282	183	310	1,040	288	122	73
	110	60	282	149	310	1,120	288	110	73
	103	56	310	149	345	1,610	256	103	73
	97	52	272	140	345	1,440	240	103	73
	97	48	221	149	351	1,020	221	110	73
	110	45	183	133	351	936	192	122	69
	110	42	174	133	413	936	192	122	62
	110	39	183	149	388	928	240	133	62
	103	36	183	174	419	928	230	133	62
	97	33	162	240	425	1,040	206	122	51
	97	30	183	256	522	1,080	192	110	62
	97		110		528		183	103	

discharge of Cut Bank Creek at Cut Bank, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
	110	79	95.2	5,850
	103	30	75.1	4,470
-31	596	110	271	9,680
	256	103	160	9,520
	528	192	340	20,900
	1,610	438	830	49,400
	992	183	467	28,700
	221	103	144	8,850
	240	51	124	7,380

TETON RIVER AT STRABANE, MONT.

TION.—In SE. ¼ sec. 35, T. 25 N., R. 7 W., on highway bridge at Peeble's ranch near Strabane, Teton County, 16 miles above Chouteau.

AGE AREA.—Not measured.

RDS AVAILABLE.—November 26, 1904, to December 31, 1906; January 16, 1908, to September 30, 1916.

E.—Chain gage on upstream side of bridge, half a mile north of ranch buildings; read by James Peebles, jr. Original gage was staff spiked to post on left bank about 40 feet above the head of Kroff's irrigation ditch; March 9, 1905, gage was moved by observer 250 feet upstream to avoid the effect of a dam erected at head of ditch below; May 8, 1905, when gage was checked from bench marks, it was found that datum had been raised 0.78 foot in the moving, but the difference between level of water surface at old and new sites was but 0.10 foot; gage datum was lowered on this date 0.20 foot. May 8, 1906, gage was moved 1½ miles upstream to Mr. Bjornstad's new ranch and set at an entirely different datum. Station discontinued during 1907, and reestablished June 16, 1908, by installing an overhanging chain gage on left bank near site of gage used during 1906; relation between gage readings not known. This gage was operated until March 23, 1911, when it was moved to present site.

Discharge measurements.—Made by wading or from bridge.

Channel and control.—Shifts occasionally; several channels at all stages, but records show total flow; beds of all channels of course gravel; water at times overflows into channels on both sides of main stream.

Extremes of discharge.—Maximum stage recorded during year 7.8 feet at 4 p. m. June 21 (discharge, 3,810 second-feet); minimum stage 3.04 feet at 11 a. m. and 4 p. m. January 13, and at 11 a. m. January 21 (discharge, 13 second-feet).

1908–1916: Maximum stage recorded 7.8 feet June 21, 1916 (discharge, 3,810 second-feet); minimum stage 3.04 feet January 13 and 21, 1916 (discharge, 13 second-feet).

Ice.—Current swift; stage-discharge relation not affected by ice.

Diversions.—Numerous diversions for irrigation, most of them below station. A large canal diverting water for the Teton Cooperative Reservoir Co., developing a Carey Act project, heads about a mile above gage.

Accuracy.—Stage-discharge relation practically premanent during year. Rating curve well defined below 2,000 second-feet. Gage read to hundredths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Teton River at Strabane, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	C. S. Heidel	3.83	92	July 12	C. S. Heidel	5.69	797
Apr. 25	.....do	3.79	88	Aug. 13	W. A. Lamb	4.59	239
June 24	W. A. Lamb	6.45	1,630	Sept. 1	C. S. Heidel	4.28	167
July 2	C. S. Heidel	6.37	1,530				

Daily discharge, in second-feet, of Teton River, Strabane, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	109	96	69	50	14	43	62	136	154	1,990	290	174
2	113	92	69	43	14	44	62	128	154	1,710	290	174
3	109	92	69	16	14	45	64	136	208	1,440	274	174
4	109	93	68	16	14	46	64	154	290	1,140	260	174
5	109	93	68	16	14	46	63	196	340	1,090	260	174
6	111	92	66	16	14	48	62	233	322	1,040	260	174
7	109	89	66	16	14	49	62	233	290	1,040	260	174
8	106	89	65	15	14	50	64	208	305	1,260	260	174
9	106	86	65	14	14	52	64	196	340	1,090	260	164
10	106	85	66	14	14	81	70	154	322	1,040	260	164
11	106	81	66	14	14	82	76	145	305	942	260	154
12	106	79	65	14	16	77	76	136	322	850	260	154
13	103	76	65	13	22	75	75	136	402	725	246	154
14	103	76	64	14	29	75	75	128	425	725	233	154
15	103	77	63	15	46	70	79	119	425	690	233	154
16	103	77	63	17	100	65	84	111	590	622	233	145
17	102	76	60	18	96	64	89	105	690	622	233	136
18	100	76	57	19	82	66	89	103	725	622	233	136
19	97	77	54	18	69	66	86	106	895	502	233	128
20	99	77	57	15	66	70	86	106	1,320	425	220	136
21	97	77	57	13	63	74	86	105	3,450	425	220	128
22	97	76	57	14	62	74	86	119	2,760	425	196	128
23	96	76	57	14	57	72	86	119	1,710	425	185	128
24	96	79	56	15	52	71	86	128	1,570	402	185	136
25	97	80	54	16	52	70	86	119	1,320	402	174	•136
26	96	79	54	16	50	69	86	119	1,440	402	185	136
27	97	76	54	14	45	65	88	128	1,640	402	174	136
28	97	76	56	14	43	62	92	136	1,990	380	174	136
29	93	74	57	14	42	64	116	136	2,140	380	174	136
30	95	70	57	13	....	64	136	136	2,140	340	174	136
31	99	....	57	13	....	64	....	154	....	305	164	....

Note.—Engineer for the Teton Cooperative Reservoir Co. estimated that the company's canal was diverting about 200 second-feet from June 12 to 17.

ischarge of Teton River at Strabane, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]	113	93	102	6,270
[illegible]	96	70	81.4	4,840
[illegible]	69	54	61.3	3,770
[illegible]	50	13	17.1	1,050
[illegible]	100	14	39.5	2,270
[illegible]	82	43	63.3	3,890
[illegible]	136	62	80.0	4,760
[illegible]	233	103	141	8,670
[illegible]	3,450	154	966	57,500
[illegible]	1,990	305	769	47,300
[illegible]	290	164	228	14,000
[illegible]	174	128	150	8,930
year	3,450	13	225	163,000

TETON RIVER NEAR CHOUTEAU, MONT.

—On south line of SW. ¼ sec. 25, T. 24 N., R. 5 W., at highway bridge about miles southwest of Chouteau, Teton County.

AGE AREA.—Not measured.

AVAILABLE.—November 30, 1904, to July 31, 1906; May 27 to December 6, ; and April 14, 1915, to September 30, 1916.

—Vertical staff fastened to pile on downstream side of bridge near left bank; by M. G. Read. Original gage, a chain attached to upstream hand rail of dge, was stolen before any observations were made; replaced May 9, 1905, by ain gage at same datum fastened to floor of bridge. Gage used in 1913 same as at used in 1915–16.

RGE MEASUREMENTS.—Made by wading, from bridge at gage, or from bridge 2 les below gage. If made from lower bridge the flow of Deep Creek must be cted.

NEL AND CONTROL.—Stream bed gravelly and likely to shift. Right bank h and not subject to overflow; left bank lower and apt to be overflowed during reme floods.

MES OF DISCHARGE.—Maximum stage during year 8.7 feet June 21, estimated m flood marks (discharge not determinable); minimum stage recorded 2.75 et April 11 (discharge 37 second-feet).

04–1906, 1913, and 1915–16: Maximum stage recorded, 8.7 feet June 21, 1916 termined from flood marks (discharge not determined); minimum stage rded August 9–16, 20, 1913 (discharge 1 second-foot). Discharge also estimated t 1 second-foot several days in April, May, and July, 1906.

—Stage-discharge relation seriously affected by ice; observations discontinued ring winter.

IONS.—Numerous diversions above gage for irrigation.

LATION.—Low flow during summer caused by diversions.

RACY.—Stage-discharge relation changed slightly during winter period and tly during high water in June. Rating curve used October 1 to December 27, d March 12 to June 7, fairly well defined; July 8 to September 30, fairly well ined. Gage read to hundredths to June 7, and to half tenths July 8 to September 30. Gage read daily except as noted in footnote to daily discharge table. ily discharge ascertained by applying daily gage height to rating tables, 0.04 being added to gage heights October 1 to December 27, before entering table .05 foot March 12 to June 7 in order to make ratings agree with measurements de October 29 and April 25. Records fair.

Discharge measurements of Teton River near Chouteau, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	C. S. Heidel	2.95	55	Aug. 13	W. A. Lamb	5.12	153
Apr. 25	.....do	2.76	38.1	Sept. 1	C. S. Heidel	4.76	70
July 12	.....do	6.2	[a]1,230	23	W. A. Lamb	4.69	53
14	W. A. Lamb	6.15	[b]1,120				

[a] Measured below mouth of Deep Creek. Subtract 478 second-feet, the flow of the creek, to obtain an estimate of the flow past gage.

[b] Includes flow of Deep Creek (378 second-feet).

Daily discharge, in second-feet, of Teton River near Chouteau, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	55	58	58	....	51	42	178	....	215	75
2	47	60	60	....	51	44	153	....	198	75
3	45	60	60	....	48	46	166	....	181	75
4	45	58	58	....	46	46	178	....	198	75
5	52	58	58	....	46	46	205	....	215	75
6	55	60	58	....	42	49	212	....	206	75
7	60	58	58	....	42	51	220	....	198	75
8	58	59	55	....	40	62	....	990	190	75
9	60	60	55	....	40	79	....	690	182	97
10	60	60	55	....	40	102	....	1,070	174	97
11	64	63	55	....	37	107	....	835	166	97
12	66	66	55	62	40	120	....	760	158	86
13	66	66	55	62	42	137	....	760	150	75
14	60	66	55	73	42	142	....	725	150	80
15	64	64	52	73	42	153	....	690	150	86
16	60	60	55	73	44	158	....	690	150	86
17	60	60	52	62	42	166	....	655	150	75
18	56	63	50	62	42	150	....	620	215	66
19	58	60	52	62	42	134	....	550	215	56
20	58	59	53	62	42	118	....	526	254	56
21	60	58	54	67	42	102	....	503	215	56
22	60	58	54	67	42	102	....	480	150	56
23	62	60	55	62	42	100	....	480	150	56
24	60	63	52	62	42	125	....	448	136	56
25	58	62	52	62	42	150	....	416	122	56
26	58	60	50	56	42	300	....	387	122	56
27	58	60	50	51	42	220	....	358	98	56
28	58	60	....	51	42	178	....	329	75	56
29	55	60	....	51	42	166	....	300	75	56
30	56	58	....	51	42	146	....	281	75	56
31	58	....	....	56	....	142	....	253	75	....

NOTE.—Discharge interpolated for lack of gage readings Nov. 8, 20, 25; Dec. 20–22; Apr. 19–20; May 18–20; June 6; July 17, 20, 21, 24, 26–28, 30, 31; Aug. 2, 4, 6–12, 16, 24, 27, 30, 31; Sept. 4, 6, 10, 12, 14, 18, 20–22, 25, 27, 29. Discharge May 23–26 estimated from observer's notes and by comparison with record of flow at near-by stations. No gage-height record Dec. 28 to Mar. 11, June 8–22, 25–30, July 1–2, 4–5 and 7.

Monthly discharge of Teton River near Chouteau, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	66	45	57.8	3,550
November	66	58	60.6	3,610
December 1–27	60	50	54.7	2,930
March 12–31	73	51	61.4	2,440
April	51	37	42.7	2,540
May	....	42	119	7,320
June 1–7	220	153	187	2,600
July 8–31	1,070	....	575	27,400
August	254	75	162	9,960
September	97	56	70.6	4,200

DEEP CREEK NEAR CHOUTEAU, MONT.

ATION.—In SW. ¼ NW. ¼ sec. 15, T. 23 N., R. 5 W., at Hugh Robinson's ranch, 5 miles southwest of Chouteau, in Teton County.

NAGE AREA.—Not measured.

RDS AVAILABLE.—March 24, 1911, to September 30, 1916.

E.—Overhanging chain on right bank, 400 feet above Hugh Robinson's house; ead by Hugh Robinson.

ARGE MEASUREMENTS.—Made by wading.

ANNEL AND CONTROL.—Bed composed of gravel. Bar of gravel about 50 feet elow gage forms principal control. Channel clean and fairly permanent. Right ank high and not subject to overflow; left bank may be overflowed.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 10.5 feet, at 7 a. m. June 21 (discharge, determined from extension of rating curve, 3,050 second-feet); minimum stage recorded, 5.5 feet, November 11, and December 21, (discharge 24 second-feet).

1911–1916: Maximum stage recorded, 10.5 feet 7 a. m., June 21, 1916 (discharge determined from extension of rating curve 3,050 second-feet); minimum stage recorded, 5.28 feet, September 25, 1913, and 5.27 feet, September 6, 1914 (discharge, 11 second-feet).

E.—Stage-discharge relation seriously affected by ice; observations discontinued during winter months.

ERSIONS.—A few small ditches divert from creek above gage.

ULATION.—None.

RACY.—Stage-discharge relation practically permanent. Rating curve well defined below 700 second-feet. Gage read to half tenths once daily. Discharge ascertained by applying daily gage height to rating table. Records good except those for periods in which stage-discharge relation was affected by ice, which are fair.

arge measurements of Deep Creek near Chouteau, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
[illegible]	5.75	49.0	June 25	8.21	[a]1,280	Aug. 12	6.11	116
[illegible]	5.80	59.	July 13	6.91	360.	Sept. 23	5.74	54.

[a] elocity determined by means of floats and coefficient of 0.85 used to reduce to mean velocity.

Daily discharge, in second-feet, of Deep Creek near Chouteau, Mont., for the year end Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Se
1	54	38	44		51	51	86	227	1,210	155	
2	54	38	38		51	51	96	244	980	155	
3	47	38	38		51	51	96	227	1,450	130	
4	47	38	38		28	51	96	260	1,060	130	
5	47	38	38		28	51	123	316	770	118	
6	50	38	35		33	51	142	356	676	118	
7	50	38	38		33	51	168	296	617	130	
8	54	38	38		33	51	196	278	1,530	107	
9	52	33	33		260	51	168	278	1,290	130	
10	51	33	33		316	51	155	316	738	142	
11	51	24	28		260	51	130	296	560	142	
12	51	27	33		196	76	118	260	478	130	
13	51	30	33		196	67	118	244	402	118	
14	47	33	33		86	58	107	244	378	155	
15	44	33	33		58	58	107	260	335	107	
16	44	38	33		76	67	107	316	316	96	
17	44	33	28		67	67	96	378	278	96	
18	44	33	33		67	67	96	426	426	168	
19	44	38	33		76	67	86	402	296	130	
20	44	38	33		76	58	96	452	260	107	
21	44	38	24		67	58	118	3,050	227	107	
22	44	38	33		67	58	118	2,410	212	86	
23	44	44	33		58	58	107	1,770	196	76	
24	42	51	33		58	58	118	1,370	196	76	
25	42	51	33		58	58	212	1,210	182	76	
26	42	44	33		58	51	452	1,130	168	118	
27	42	46		51	51	58	426	1,130	196	96	
28	38	48		51	51	76	532	1,290	316	76	
29	38	51		51	51	96	316	1,530	260	76	
30	38	51			51	96	278	1,610	212	67	
31	38				51		244		182	58	

NOTE.—Discharge for following days interpolated because of ice effect: Nov. 12, 13, 27, 28, Dec. 19, 24 Mar. 1 and 2. Gage not read Dec. 27 to Feb. 26. Discharge Dec. 27–31, estimated 30 second-feet. Discha June 22 interpolated; gage not read.

Monthly discharge of Deep Creek near Chouteau, Mont., for the year ending Sept. 30, 19

Month.	Discharge in second-feet.			Run-o (total i acre-fee
	Maximum.	Minimum.	Mean.	
October	54	38	45.9	2,
November	51	24	38.6	2,
December	44	24	33.3	2,
February 27–29	51	51	51.0	
March	316	28	85.9	5,
April	96	51	60.4	3,
May	532	86	171	10,
June	3,050	227	753	44,
July	1,530	168	529	32,
August	168	58	112	6,
September	182	51	77.2	4,

WILLOW CREEK NEAR CHOUTEAU, MONT.

LOCATION.—In sec. 14, T. 23, N., R. 6 W., at McPhee's ranch, 12 miles southwest Chouteau, in Teton County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 2, 1912, to September 30, 1916.

GAGE.—Staff gage on left bank, about half a mile below the house of S. A. McPh read by S. A. McPhee.

DISCHARGE MEASUREMENTS.—Made by wading at the gage, except at extremely hi stages, when they may be made from a bridge half a mile below gage.

CHANNEL AND CONTROL.—A gravel bar 30 feet below the gage is the control; slight shifting. Banks about 4 feet high; subject to overflow only at extreme flo stages.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 6.60 feet at 5.30 p. m. June 21 (discharge 880 second-feet); minimum stage, 1.54 feet at 3 p. m. November 10 (discharge, 9 second-feet).

1912–1916: Maximum stage recorded, 6.60 feet, June 21, 1916 (discharge 880 second-feet); minimum stage, dry July 20 to end of season, 1914.

.—Stage-discharge relation seriously affected by ice; observations discontinued during winter; probably little flow.

RSIONS.—Several diversions above the station, mostly to water hay land; very little water used except during very dry periods.

LATION.—None.

URACY.—Stage-discharge relation not permanent; affected by growth of moss and weeds during summer and seriously affected by ice during winter. Two fairly well defined rating curves used, one applicable October 1 to December 20, the other March 12 to July 18 and September 15–30. Gage read to quarter tenths once daily. Discharge ascertained by applying daily gage height to rating tables except for period July 19 to September 4, for which it was obtained by shifting-control method. Records fair.

arge measurements of Willow Creek near Chouteau, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

ate.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
	1.71	18.5	June 24	4.24	386	Aug. 13	2.04	[a]31.6
	1.87	24.4	July 13	2.45	86	Sept. 23	1.66	12.9

[a] Moss on control.

discharge in second-feet, of Willow Creek near Chouteau, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	16	10	13		26	34	113	305	40	24
	14	10	13		30	32	100	233	26	35
	14	12	13		26	30	93	206	21	60
	13	12	13		26	34	100	133	26	57
	14	13	13		29	30	106	142	32	46
	16	13	13		26	30	93	135	33	36
	16	12	13		26	34	86	128	33	29
	18	12	13		24	39	73	190	25	18
	19	10	13		29	34	73	174	29	29
	19	9	13		26	30	70	166	37	33
	18	10	13		30	34	67	150	41	29
	16	13	12	113	34	30	61	128	36	29
	16	13	12	128	32	30	58	86	32	33
	16	13	12	86	30	29	55	74	30	28
	16	12	10	73	30	26	52	74	26	23
	16	12	10	61	30	30	49	80	25	23
	16	12	12	49	30	34	41	74	37	20
	14	13	12	44	30	30	49	70	33	17
	14	12	13	39	29	26	61	62	20	16
	14	12	13	30	26	23	206	57	25	16
	13	13		49	26	20	880	46	26	14
	13	13		39	26	17	858	40	22	13
	13	13		30	24	17	600	37	19	13
	13	19		34	23	30	381	35	16	17
	13	18		30	20	72	343	33	19	12
	13	18		30	17	113	287	33	23	14
	12	16		30	17	174	251	57	20	17
	12	14		30	20	182	305	102	18	20
	12	13		30	23	174	224	96	17	23
	12	13		23	30	158	498	81	18	23
	10			23		142		56	20	

OTE.—Discharge Dec. 21–31 estimated, because of ice, at 12 second-feet. Gage not read Jan. 1 to ar. 11.

Monthly discharge of Willow Creek near Chouteau, Mont., for the year ending Sept. 30, 1

Month.	Discharge in second-feet.			Run- (total acre-fe
	Maximum.	Minimum.	Mean.	
October	19	10	14.5	
November	19	9	12.8	
December	13	10	12.3	
March 12-31	128	23	49.0	
April	34	17	26.5	
May	182	17	55.4	
June	880	41	206	
July	305	33	105	
August	41	16	26.9	
September	60	12	25.6	

MUDDY CREEK NEAR BYNUM, MONT.

Location.—In NW. ¼ SE. ¼ sec. 22, T. 26 N., R. 6 W., 400 feet above mouth of Bl leaf Creek and about 2 miles above Bynum, in Teton County.

Drainage area.—Not measured.

Records available.—May 24, 1912, to September 30, 1916.

Gage.—Vertical staff on right bank; read by George Miller. A temporary vert staff about 20 feet downstream was used June 23 to July 20, 1916, to replace re lar gage, which had been washed out; July 21 new low water staff was se regular section. Prior to October 5, 1914, gage in use was overhanging chain left bank 100 feet upstream from present gage and at different datum.

Channel and control.—Stream bed sand and gravel; may shift. Left bank h and not subject to overflow; right bank gradually sloping; apparently one ch nel at all stages.

Extremes of discharge.—Maximum stage during year, 6.9 feet June 21, de mined by leveling from flood marks (discharge, determined from extension rating curve, 976 second-feet); minimum stage recorded, 2.25 feet October 29 and November 7-9 (discharge 0.5 second-foot).

1912-1916: Maximum stage recorded June 21, 1916; channel dry August 23, 24, 31; September 1-3, 10, 29; and October 7, 1912.

Ice.—Stage-discharge relation seriously affected by ice; observations discontin during winter.

Diversions.—Three small ditches divert above the station, and the Teton Coope tive Reservoir Co. proposes to store the floodwaters.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during year. Rat curve used October 1 to November 26 fairly well defined; curve used March to September 30 well defined below 600 second-feet. Gage read to quarter ten once daily; during high water read oftener. Discharge ascertained by applyi daily gage height to rating table. Records good.

Discharge measurements of Muddy Creek near Bynum, Mont., during the year end Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Di char
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-*
Oct. 29	C. S. Heidel	2.27	1.0	July 12	C. S. Heidel	3.32	6
Apr. 25	do	2.41	2.5	Aug. 13	W. A. Lamb	2.63	
June 23	W. A. Lamb	5.30	500	Sept. 1	C. S. Heidel	2.50	
July 2	C. S. Heidel	4.00	172				

Daily discharge, in second-feet, of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	1.0	0.8	....	8.0	2.0	14	192	13	3.6
	1.0	.8	....	8.0	2.4	13	172	13	3.6
	1.0	.8	....	7.2	2.0	10	333	12	10
	1.0	.8	....	4.8	2.0	9.0	153	8.0	32
	1.0	.8	....	4.8	2.0	9.0	102	8.0	16
	1.0	.8	....	4.0	2.0	12	87	8.0	10
	1.0	.5	....	4.0	2.0	14	87	19	10
	1.0	.5	....	3.6	2.0	13	118	14	6.0
	1.0	.5	....	3.6	2.0	12	202	13	4.8
	1.0	1.0	....	3.6	1.7	14	102	22	4.8
	1.0	1.0	....	4.0	2.0	13	80	20	7.2
	1.0	1.0	....	3.6	2.0	12	62	14	4.8
	1.0	1.0	....	3.6	2.0	10	55	10	4.0
	1.0	1.0	....	3.6	2.0	9.0	50	9.0	4.0
	1.0	1.0	....	3.0	2.0	8.0	45	7.2	4.8
	1.0	1.0	....	3.0	2.0	8.0	36	6.0	4.8
	.8	1.0	....	3.6	2.0	10	32	4.0	4.0
	.8	1.0	....	3.6	2.0	12	50	8.0	3.6
	.8	1.0	....	3.6	2.0	12	45	18	3.6
	.8	1.0	....	3.6	2.0	18	34	12	3.6
	.8	1.0	....	3.6	2.0	976	25	10	3.6
	.8	1.0	....	3.6	1.7	946	22	4.0	3.6
	.8	1.0	....	3.6	2.0	706	19	4.0	3.0
	.8	1.0	4.0	3.6	2.4	360	18	3.6	3.0
	.8	1.0	4.8	2.2	3.6	360	16	3.6	3.0
	.8	1.0	6.0	2.4	12	307	16	6.0	2.0
	.8	....	4.0	2.4	102	307	32	4.0	2.4
	.8	....	4.0	2.4	102	444	28	4.0	3.6
	.5	....	4.0	2.0	33	766	25	4.0	4.0
	.5	....	4.8	2.0	26	360	19	4.0	4.0
	.5	....	6.0	....	18	....	18	3.6	....

NOTE.—Gage out June 21–22; discharge estimated from high-water marks and extension of rating curve. Stage-discharge relation seriously affected by ice Nov. 27 to Dec. 4; data inadequate for determination of discharge. Gage not read Dec. 5 to Mar. 23.

Monthly discharge of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1919.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1.0	0.5	0.87	53
November 1–26	1.0	0.5	.90	46
March 24–31	6.0	4.0	4.70	75
April	8.0	2.0	3.82	227
May	102	1.7	11.1	682
June	[a] 976	8.0	192	11,400
July	333	16	73.4	4,510
August	22	3.6	9.32	573
September	32	2.0	5.91	352

[a] Crest stage; discharge determined from elevation of high-water marks and extension of rating curve.

BLACKLEAF CREEK NEAR BYNUM, MONT.

LOCATION.—In NW. ¼ SE. ¼ sec. 22, T. 26 N., R. 6 W., about 200 feet above mouth of creek and 2 miles above Bynum, in Teton County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 24, 1912, to September 30, 1916.

GAGE.—Overhanging chain gage on left bank, about 100 feet west of an abandoned barn; read by George Miller.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Banks fairly high; overflow not probable. Stream bed fine sand and gravel; shifts occasionally.

Extremes of discharge.—Maximum stage recorded during year, 5.85 feet June 2 determined by leveling from flood marks (discharge, determined from extensio of rating curve, 600 second-feet); minimum stage recorded 2.02 feet March 26–2 (discharge 4.5 second-feet).

1912–1916: Maximum stage recorded June 21, 1916; channel "dry" July 2 to October 3, 1914.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinue during winter.

Diversions.—Most of the flow at low stages is diverted above the station for irrigatio and the Teton Cooperative Reservoir Co. proposes to use the flood waters.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent, as channel shifts occasionall Rating curves used as follows: October 1 to December 4, fairly well define March 24 to June 20, fairly well defined; June 21 to September 30, well define below 400 second-feet. Gage read to quarter tenths twice daily during perio of changing stage and high water, and once daily during periods of nearly unifor flow. Daily discharge ascertained by applying mean daily gage height to ratin table. Record fair October 1 to December 4, March 24 to June 20, and good Jun 21 to September 30.

Discharge measurements of Blackleaf Creek near Bynum, Mont., during the year endin Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Dis-charg
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-f*
Oct. 29	C. S. Heidel	2.00	5.0	July 12	C. S. Heidel	3.86	49.
Apr. 25	.....do	2.12	6.3	Aug. 13	W. A. Lamb	3.50	19.
June 23	W. A. Lamb	5.14	342.	Sept. 1	C. S. Heidel	3.31	8.
July 2	C. S. Heidel	4.34	119.				

Daily discharge, in second-feet, of Blackleaf Creek near Bynum, Mont., for the year endin Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.8	6.5	7.4	....	10.	8.6	43	137	28	8.
2	7.4	7.4	8	....	9.5	13	37	122	26	10
3	8.0	7.4	11	....	9.5	12	32	236	23	18
4	10	8.0	11	....	8.9	9.2	31	124	21	47
5	8.8	8.0	....	....	7.1	7.7	27	81	21	27
6	8.8	7.4	....	....	7.1	6.8	25	72	19	18
7	11	7.4	....	....	7.1	12	25	62	17	16
8	12	6.5	....	....	7.1	6.8	23	96	16	13
9	11	5.6	....	....	7.1	6.2	21	168	35	12
10	8.0	8.8	....	....	7.1	5.8	21	91	36	12
11	8.8	10	....	....	8.9	6.2	21	63	28	10
12	8.8	10	....	....	10	6.8	19	50	27	12
13	8.0	11	....	....	8.9	6.8	17	42	24	18
14	8.0	11	....	....	8.9	6.8	15	39	20	22
15	8.0	10	....	....	8.0	8.6	14	33	16	24
16	8.0	10	....	....	7.1	8.6	13	32	12	20
17	7.4	6.5	....	....	7.4	8.6	12	30	9.5	18
18	6.5	5.6	....	....	7.4	7.7	12	50	18	16
19	7.4	10	....	....	7.4	6.8	12	48	22	15
20	6.5	10	....	....	7.4	6.2	18	33	15	13
21	5.6	7.4	....	....	7.4	5.8	600	28	12	12
22	5.6	7.4	....	....	7.4	5.8	580	24	10	12
23	5.6	6.5	....	....	7.4	5.8	450	28	9.5	12
24	5.6	6.5	....	8.0	7.4	7.7	207	33	8.0	12
25	5.6	5.6	....	6.0	7.1	11	180	28	6.8	12
26	5.6	5.6	....	4.5	7.1	19	168	30	60	10
27	5.6	8.0	....	4.5	7.1	134	144	40	38	12
28	5.6	7.4	....	7.1	7.1	134	504	39	22	15
29	5.0	6.5	....	7.1	7.1	69	580	39	13	18
30	5.0	7.4	....	8.0	8.0	53	266	33	13	15
31	5.6	....	....	8.9	....	44	....	30	10	

Note.—Discharge, June 21, 22, and 29, determined from high water marks; June 23, by average est mated flow for the morning, when stage was too high for the observer to cross river, with that correspon ing to gage reading in afternoon. Gage not read Dec. 5 to Mar. 23.

discharge of Blackleaf Creek near Bynum, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber	12	5.0	7.47	459
ber	11	5.6	7.85	467
er 1-4	11	7.4	9.35	74
31	8.9	4.5	6.76	107
[illegible]	10	7.1	7.83	466
[illegible]	134	5.8	21.0	1,290
[illegible]	a600	12	137	8,150
[illegible]	236	24	63.3	3,890
[illegible]	60	6.8	20.5	1,260
[illegible]	47	8.5	16.0	952

a Crest stage; estimated from elevation of high-water marks and extension of rating curve.

MUSSELSHELL RIVER BASIN.

MUSSELSHELL RIVER AT HARLOWTON, MONT.

TION.—In sec. 26, T. 8 N., R. 15 E., at highway bridge 1 mile south of Harlowton, Meagher County.

AGE AREA.—Not measured.

RDS AVAILABLE.—July 11, 1907, to September 30, 1916.

ES.—Chain gage on upstream side of public highway bridge; read by W. G. Yamamoto. Before October, 1908, a staff gage fastened to the center of old highway bridge; April 10, 1919, a temporary staff gage was installed which read 0.73 foot high and which was used until May 24, 1909, when gage was lowered and the datum changed, so that the difference between the bench mark and the zero of the gage is 0.52 foot greater than formerly. No change has been made in gage or datum since May 24, 1909.

HARGE MEASUREMENTS.—Made from bridge or by wading.

NNEL AND CONTROL.—Stream bed sand and gravel. Bar or ridge crosses the stream about 75 feet below the gage; shifts. Banks fairly high and probably not subject to overflow; water forced to pass under bridge as wagon road is filled and graded almost to the level of bridge floor.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 2.74 feet at 6.40 a. m. June 22 (discharge, 1,240 second-feet); minimum stage 0.33 foot at 6.40 a. m. and 6.30 p. m. September 4 (discharge 25 second-feet).

1907–1916: Maximum stage recorded, 4.85 feet, May 30–31, 1908 (discharge 2,940 second-feet); minimum stage recorded, "dry" August 4–11, 1910.

T.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

ERSIONS.—Numerous ditches divert from headwater streams, and from the Musselshell above station.

ULATION.—None.

RACY.—Stage-discharge relation unchanged during year. Rating curve well defined above 40 second-feet. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Musselshell River at Harlowton, Mont., during the year ending Sept. 30, 1916.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
[illegible]	1.18	203	July 25	0.79	85
[illegible]	2.11	722	Sept. 23	.56	47.7

Daily discharge, in second-feet, of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	226	142	....	170	305	715	680	64	27
2	221	142	....	177	278	750	645	52	27
3	217	142	....	185	250	715	645	49	27
4	217	142	....	174	256	690	612	46	25
5	217	142	....	163	296	715	549	42	27
6	217	142	....	139	353	860	458	46	29
7	213	142	....	136	458	750	430	51	33
8	209	136	....	136	612	715	373	52	34
9	209	124	....	139	549	715	329	51	37
10	213	112	....	149	518	822	378	47	39
11	217	107	....	174	458	900	329	46	41
12	203	100	....	201	430	785	282	45	41
13	197	100	....	287	430	715	226	45	42
14	197	100	....	234	430	645	193	45	43
15	185	100	....	243	403	645	170	45	47
16	181	100	....	274	378	680	160	43	47
17	174	....	....	256	353	715	146	42	47
18	170	....	....	247	353	715	133	42	47
19	160	....	329	230	353	785	124	42	43
20	160	....	329	226	378	822	110	39	43
21	149	....	353	217	430	1,060	107	38	46
22	146	....	353	226	488	1,200	107	36	47
23	142	....	292	226	458	1,020	100	34	47
24	142	....	234	213	458	900	95	32	47
25	142	....	197	209	715	822	86	33	47
26	142	....	170	217	680	822	82	34	47
27	142	....	156	217	549	822	72	33	48
28	142	....	160	269	518	860	70	32	51
29	142	....	181	329	549	940	74	29	51
30	142	....	177	329	580	900	70	29	53
31	142	....	166	....	645	....	65	27	....

NOTE.—Stage-discharge relation seriously affected by ice Nov. 17 to Dec. 25. No gage-height record Dec. 26 to Mar. 18.

Monthly discharge of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	226	142	180	11,100
November 1-16	142	100	123	3,900
March 19-31	353	156	238	6,140
April	329	136	213	12,700
May	715	256	449	27,600
June	1,200	645	806	48,000
July	680	65	255	15,700
August	64	27	41.6	2,560
September	53	25	41.0	2,440

FLATWILLOW CREEK NEAR FLATWILLOW, MONT.

LOCATION.—In sec. 23, T. 12 N., R. 25 E., at Flatwillow Ranch Co.'s ranch, 8 miles above Flatwillow, Fergus County, and 30 miles north of Roundup.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1911, to September 30, 1916.

GAGE.—Vertical staff just below the wagon bridge near the ranch buildings; read by J. D. Brinegar.

DISCHARGE MEASUREMENTS.—Made from footbridge at house or by wading at ford below house.

CHANNEL AND CONTROL.—Banks high and thickly overgrown with willows. Stream bed earth; current sluggish; weeds grow in stream bed during summer; control shifts.

EMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet June 29 (discharge, 180 second-feet); minimum stage 2.3 feet August 8–12, 14, and September 1–2 (discharge, 21 second-feet).

1911-1916: Maximum stage recorded, 7.6 feet June 13, 1913 (discharge, 307 second-feet); minimum stage, 2.1 feet September 3–4, 1912 (discharge, 1.0 second-foot).

—Stage-discharge relation seriously affected by ice; data insufficient to warrant estimates of flow.

ERSIONS.—Numerous above gage.

LATION.—None.

RACY.—Stage-discharge relation changed by ice during the winter. Rating curve used October and November well defined; curve used March 20 to September 30 well defined below 100 second-feet. Gage read once daily to tenths. Discharge ascertained by applying daily gage height to rating table. Records good.

arge measurements of Flatwillow Creek near Flatwillow, Mont., during the year ending Sept. 30, 1916.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
	3.21	52	July 26	2.99	48.4
	3.41	68	Sept. 22	2.41	24.9

discharge, in second-feet, of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	50	50		46	38	67	128	32	21
	50	50		46	38	67	122	32	21
	55	50		46	38	67	110	32	22
	55	55		46	38	77	93	32	22
	53	53		44	36	72	88	28	26
	55	55		42	30	67	88	24	24
	55	55		42	30	67	88	22	26
	55	50		42	30	67	77	21	24
	55	50		38	30	72	67	21	28
	53	50		40	32	82	67	21	30
	55	50		42	30	77	82	21	28
	55	50		46	26	77	77	21	32
	55	50		46	38	77	72	22	34
	55	50		46	38	77	72	21	28
	53	50		49	40	58	67	24	30
	55	50		46	34	38	67	28	28
	55	50		46	34	40	67	30	28
	55	50		42	34	46	67	28	26
	55	50		42	30	58	67	28	28
	48	48	67	44	32	77	60	28	26
	50	50	60	42	30	140	58	28	26
	50	50	60	42	30	98	58	28	24
	50	55	56	42	30	98	51	30	26
	50	62	56	38	34	88	53	28	22
	48	57	53	40	58	93	51	28	24
	50	50	51	38	67	88	49	26	24
	50	50	51	38	56	110	46	26	28
	50	50	51	38	56	160	49	26	26
	50	50	46	38	60	180	44	28	28
	48	50	49	40	62	134	40	26	28
	50		46		60		36	22	

—Discharge Nov. 8–17 and 26–30 estimated because of ice. Considerable run-off during February first half of March; water flowed on top of ice. Data inadequate for determination of discharge, to Mar. 19.

Monthly discharge of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	55	48	52.4	3,220
November			51.3	3,060
March 20-31	67	46	53.8	1,280
April	49	38	42.6	2,530
May	67	26	39.3	2,420
June	180	38	84.0	5,000
July	128	36	69.7	4,290
August	32	21	26.2	1,610
September	34	21	26.3	1,560

MILK RIVER BASIN.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

Location.—In SW. ¼ sec. 29, T. 37 N., R. 9 W., at Richard Croff's ranch, just above Kennedy Coulee, in Teton County, 6 miles south of international boundary and about 30 miles northeast of Browning.

Drainage area.—288 square miles.

Records available.—April 28, 1905, to September 30, 1916.

Gage.—Stevens water-stage recorder installed April 12, 1913, on left bank opposite the house of the observer, Wm. Welch; April 28 to May 8, 1905, a staff; May 8, 1905, to April 13, 1913, an overhanging chain gage. Datum unchanged.

Discharge measurements.—Made from cable 150 feet above gage, or by wading.

Channel and control.—Bottom of channel is composed of clay and small boulders. Growth of aquatic plants affects stage-discharge relation at low stages during summer. Banks high and not subject to overflow except at extremely high stages.

Extremes of discharge.—Maximum stage recorded during year, 8.6 feet February 16 (discharge, 2,840 second-feet); minimum stage, 2.60 feet, January 17 and 26 (discharge, 19 second-feet).

1905–1916: Maximum stage recorded, 15.4 feet, June 6, 1908, determined from high-water marks (discharge not computed; flood width, 850 feet; flood cross-section about 2,600 square feet); minimum stage recorded, 2.9 feet, August 18–20, 1906 (discharge, 1 second-foot).

Ice.—Stage-discharge relation affected by ice for short periods.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by aquatic growth in channel and ice. Rating curves used as follows: October 1 to November 10, fairly well defined; November 27 to March 11, fairly well defined between 50 and 170 second-feet; April 2 to June 2 and July 1 to September 30, well defined between 40 and 1,520 second-feet. Stage-discharge relation November 11, 12 and 29, affected by ice; assumed not affected rest of season, the assumption being based on comparison with records of flow of other streams, study of hydrographs and weather records. Chain gage read twice daily to hundredths October 1 to November 12, once daily to half tenths, November 27 to March 10, July 8–18, and September 20–30; stage during rest of year ascertained from recordergraph by inspection. Daily discharge ascertained by applying mean daily gage height to rating table except for periods during which stage-discharge relation was affected by shifting control, or ice, or days of considerable fluctuation. Records good.

Cooperation.—Station maintained in cooperation with the Irrigation Branch, Department of the Interior, Canada.

[illegible] measurements of South Fork of Milk River near Browning, Mont., during the year ending Sept. 30, 1916.

	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
	V. A. Newhall [a]	3.31	104	June 1	S. H. Frame	4.25	395
	W. H. Storey [a]	[b] 3.09	64	11	A. H. Tuttle	4.45	411
	W. A. Lamb	2.91	52	21	S. H. Frame	4.38	433
	W. H. Storey	2.93	59	27	do	4.35	468
	W. A. Lamb	6.25	1,430	July 19	W. A. Lamb	3.35	146
	S. H. Frame [a]	3.86	229	27	W. A. Burton [a]	3.15	95
	do	3.47	157	Aug. 22	W. A. Lamb	3.01	77
	do	3.41	150	Sept. 6	S. H. Frame	3.22	113
	W. A. Lamb	3.45	156	19	W. A. Lamb	2.83	52
	Tuttle and Lamb	3.70	225	28	S. H. Frame	2.88	53

[a] Engineer, Irrigation Branch, Department of the Interior, Canada.
[b] Stage-discharge relation affected by ice.

Discharge, in second-feet, of South Fork of Milk River near Browning, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	67	60	52	28	28	75	220	194	419	467	85	59
	68	62	52	24	28	75	257	266	509	338	72	59
	88	64	52	28	28	75	225	251	334	314	65	95
	97	66	57	28	34	83	184	239	266	304	60	279
	99	66	62	28	34	75	165	242	266	269	56	202
	94	67	67	28	28	75	147	239	338	242	56	112
	104	51	56	28	28	75	158	234	266	217	55	87
	101	39	60	28	24	111	174	234	228	217	53	77
	97	42	60	28	28	900	201	207	201	217	84	71
	101	50	52	28	28	1,640	214	201	291	191	222	70
	91	64	52	28	28	1,520	217	186	381	167	167	68
	98	63	52	28	34	1,300	242	184	334	179	121	66
	91	62	52	28	34	777	234	184	251	145	100	65
	90	61	52	28	34	568	204	186	231	145	107	58
	102	60	52	28	39	448	217	191	217	145	100	62
	97	60	39	24	2,840	346	251	194	228	125	80	59
	88	59	39	19	1,880	308	214	186	228	145	74	58
	80	58	28	24	1,260	293	196	174	239	145	104	53
	70	57	28	28	792	281	196	165	257	135	147	49
	61	56	34	28	1,230	314	189	160	359	116	111	48
	70	55	28	28	960	355	177	158	431	109	92	47
	70	55	34	28	359	314	177	156	545	102	77	47
	64	54	34	24	359	234	174	158	616	100	74	46
	64	53	34	24	359	199	181	196	439	98	68	45
	61	52	39	24	341	191	174	260	359	97	65	49
	61	52	34	19	275	186	152	322	381	97	64	49
	60	52	34	24	92	207	169	616	460	120	71	53
	70	52	28	28	92	212	204	626	484	154	70	56
	67	52	28	28	83	189	212	484	536	112	65	58
	61	52	28	34		179	201	592	670	100	64	59
	61		28	28		174		451		93	60	

—Discharge Mar. 12 to Apr. 1 and June 3-30, computed by shifting-control method. Discharge 11, 15-18, May 26, 27, 29, June 28, 29, July 1, Aug. 9, 10, and Sept. 3-5, ascertained by weighting obtained by applying gage heights for parts of days to rating table. Discharge estimated, of ice, Nov. 11, 12, and 29, and interpolated because of missing gage heights Nov. 2-5, 13-26, Dec. 31, Jan. 5-10, July 8, Sept. 20-23, 26, 27, and 28. See "Accuracy" in description of station.

Monthly discharge of South Fork of Milk River near Browning, Mont., for the year endi Sept. 30, 1916.

[Drainage area, 288 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet
October	104	60	80.4	0.279	0.32	4,9
November	67	39	56.5	.196	.22	3,3
December	67	28	43.5	.151	.17	2,6
January	34	19	26.7	.093	.11	1,6
February	2,840	24	390	1.35	1.46	22,4
March	1,640	75	380	1.32	1.52	23,4
April	257	147	198	.688	.77	11,8
May	626	156	262	.910	1.05	16,1
June	670	201	358	1.24	1.38	21,3
July	467	93	174	.604	.70	10,7
August	222	53	86.7	.301	.35	5,3
September	279	45	73.5	.255	.28	4,3
The year	2,840	19	176	.611	8.33	128,0

MILK RIVER AT INTERNATIONAL BOUNDARY.

Location.—In SE. ¼ sec. 3, T. 1, R. 5 W. fourth meridian, Alberta, Canada, at interna tional boundary, 30 miles north of Rudyard, in Hill County, Mont., the neare railroad station.

Drainage area.—2,514 square miles (measured by Irrigation Branch, Departmen of the Interior, Canada.)

Records available.—April 1, 1913, to September 30, 1916. From August 7, 1909 to April 1, 1913, station was maintained by Canada.

Gage.—Gurley printing water-stage recorder on left bank, installed August 13, 1913 At the station maintained by Canada readings were obtained from a staff gage o the right bank about 1,000 feet above site of present gage. Gage read by Fran Galloway.

Discharge measurements.—Made from cable about 1,000 feet above gage, or b wading near the gage.

Channel and control.—Bed of stream sandy; shifting. Banks high above an below gage; not subject to overflow at ordinary high stages.

Extremes of discharge.—Maximum discharge during year estimated at 3,50 second-feet, July 3; minimum discharge estimated at 18 second-feet January 1 t February 14.

1909–1916: Maximum discharge estimated at 3,500 second-feet July 3, 1916 channel reported dry August 3–17, 22, 23, 1914.

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from discharg measurements, weather records and observer's notes, and flow at near-by stations

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent because of shifting control and effect of ice. Numerous discharge measurements necessary to determine the flow; 19 measurements made during the year ending September 30, 1916. Two rating curves, each well defined except at high stages, were used, one applicable April 17 to May 5 and September 7–13, the other applicable June 15 to September 6. Discharge March 14–28 based on measurements and gage heights referred to gage at cable. Mean daily gage height October 1 to December 25, and March 29 to September 30 obtained by averaging gage heights registered every 15 minutes by Gurley weight-driven recorder. Gage heights January 2 to February 22, and March 14 were read on outside staff gage at recorder; gage heights March 15–28 were read on staff gage at cable. No readings obtained December 26 to January, 1 and February 23 to March 13. Gage read to hundredths at low stages and to half tenths at high stages. Stage-discharge relation affected by ice November 11 to March 13. Daily discharge ascertained by applying mean daily gage height to rating tables except for periods during which stage-discharge relation was affected by ice or shifting control. Record good except for winter months.

COOPERATION.—Station maintained in cooperation with and computations made by the Irrigation Branch, Department of the Interior, Canada.

Discharge measurements of Milk River at international boundary during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
8	W. H. Story a	3.70	228	May 12	A. H. Tuttle	3.54	287
[illegible]	....do	3.61	177	17	H. W. Rowley	3.50	248
22	W. A. Lamb	b 3.75	90	June 12	....do	4.37	722
14	L. J. Gleeson a	6.64	2,064	14	A. H. Tuttle	4.81	939
15	W. A. Lamb	c 5.51	1,190	July 7	H. W. Rowley	4.41	686
23	L. J. Gleeson	d 4.20	766	28	....do	3.49	228
31	....do	e 3.69	413	Aug. 17	....do	3.54	251
12	....do	3.68	392	Sept. 7	W. A. Lamb	4.67	971
30	W. A. Lamb	3.36	231	13	H. W. Rowley	3.39	255
3	H. W. Rowley a	3.50	297				

a Engineer, Irrigation Branch, Department of Interior, Canada.
b Stage-discharge relation affected by ice.
c Staff gage at cable read 4.61 feet.
d Staff gage at cable read 3.68 feet.
e Staff gage at cable read 3.03 feet.

Daily discharge, in second-feet, of Milk River at international boundary for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	166	136	65	....	344	289	1,130	1,100	258	155
	166	143	63	....	314	354	1,060	1,370	196	155
	187	151	62	....	274	375	915	3,500	170	151
	189	153	62	....	354	319	946	2,000	162	341
	187	153	61	....	454	339	1,000	1,200	158	322
	189	156	59	....	508	446	871	800	148	360
	212	153	57	....	484	355	784	688	158	973
	230	153	55	....	465	346	706	623	415	709
	239	147	53	....	447	346	883	1,480	254	530
	224	136	51	....	428	331	803	1,000	258	412
	248	132	49	....	410	317	927	706	410	344
	252	128	48	....	391	303	748	594	553	274
	233	124	47	....	391	267	688	505	527	240
	212	120	45	2,060	391	258	896	415	390	232
	215	116	40	1,190	391	237	712	336	303	232
	224	112	39	964	391	245	589	478	258	232
	224	108	39	826	391	245	555	462	245	216
	221	104	37	866	406	245	510	312	317	237
	213	101	37	825	412	245	532	317	289	216
	205	98	35	784	406	271	425	312	258	188
	192	94	38	744	433	237	415	289	241	166
	180	90	33	816	385	204	688	294	276	162
	164	88	29	766	339	204	700	271	327	151
	162	86	27	706	375	204	803	224	312	144
	162	84	26	602	370	635	865	208	241	137
	164	81	25	520	375	852	877	216	196	124
	162	79	25	408	339	946	754	220	181	131
	151	77	25	356	309	915	641	241	166	127
	145	73	25	296	289	1,060	670	241	158	120
	137	72	25	396	245	1,160	896	280	155	131
	136	--------	25	384	....	1,070	....	346	151	....

NOTE.—Discharge computed by indirect method for shifting control Oct. 1 to Nov. 10, Mar. 29 to Apr. 16, and May 6 to June 14. Discharge estimated because of ice from study of gage heights, weather records, and flow at near-by stations as follows: Nov. 14 to Dec. 31, as in table; Jan. 1–31, 18 second-feet; Feb. 1–14, 18 second-feet; Feb. 15–29, 2,160 second-feet; Mar. 1–13, 700 second-feet. Discharge interpolated Nov. 11–13, Mar. 23, 28, Apr. 7–11, 13–16, and estimated July 3-6. See Accuracy in description of station.

Monthly discharge of Milk River at international boundary for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	252	136	193	11,900
November	156	72	115	6,840
December	65	25	42.1	2,590
January			18.0	1,110
February			1,130	65,000
March			730	44,900
April	503	245	384	22,800
May	1,160	204	439	27,000
June	1,130	415	766	45,600
July	3,500	208	678	41,700
August	553	148	262	16,100
September	973	120	264	15,700
The year			415	301,000

Note.—See footnote to daily-discharge table.

MILK RIVER AT HAVRE, MONT.

Location.—In SW. ¼ SW. ¼ sec. 4, T. 32 N., R. 16 E., at highway bridge at Havre, in Hill County.

Drainage area.—Not measured.

Records available.—May 15, 1898, to September 30, 1916.

Gage.—Chain gage fastened to rail on downstream side of bridge; read by C. W. Ling United States Weather Bureau observer. Owing to shifting of river bed at low water the gage frequently has to be moved from one end of the bridge to the other, but it was not so moved during 1916; datum unchanged.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Stream bed sand and earth; shifts greatly. Banks are overflowed at high stages.

Extremes of discharge.—Maximum stage recorded during year, 17.2 feet March 12 (discharge not determined); minimum discharge (measured) 7.5 second-feet January 29.

1898–1916: Maximum stage recorded, 17.2 feet March 12, 1916 (discharge not determined); channel reported "dry" July 16–18, 1898; August 16–20, 1904, July 25, August 18–26, 1905; November 16 to December 31, 1906; July 28 to September 14, 1910; July 29 to August 22, 1914.

Ice.—From the last part of November to the first part of April the river at Havre is frozen over, and in portions of the cross section it is usually frozen to the bottom

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by shifting control and, from November 11 to March 26, by ice. Rating curve used March 27 to April 23, poorly defined; that used March 4–25 and July 4 to September 30, well defined between 100 and 1,500 second-feet. Gage read once daily to tenths prior to September 4 and twice daily to hundredths after that date. Daily discharge ascertained by applying daily gage height to rating tables except for period during which stage-discharge relation was affected by shifting control or ice Records fair.

scharge measurements of Milk River at Havre, Mont., during the year ending Sept. 30, 1916.

	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
	W. A. Lamb	a 6.10	54	May 27	A. H. Tuttle	8.13	1,090
	do	b 5.45	12.6	June 15	do	8.68	1,020
	do	(c)	7.5	July 17	do	7.75	640
	do	d 9.98	1,060	27	do	8.49	1,100
	A. H. Tuttle	6.66	265	Aug. 23	do	6.81	270
4	do	7.03	356	Sept. 7	W. A. Lamb	7.64	619
	do	6.75	249	12	do	7.20	428

-discharge relation affected by ice.

-discharge relation affected by ice. Measurement made from ice cover 400 feet below gage and Havre sewer. Sewer discharging one or two second-feet.

frozen solid at gage. Measurement made from ice cover 200 feet below gage and below Havre Sewer discharging one or two second-feet.

-discharge relation affected by ice jam below gage.

y discharge, in second-feet, of Milk River at Havre, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	145	129	....	381	316	1,310	1,240	419	213
	145	129	....	381	349	1,380	1,380	341	241
	145	129	....	381	275	1,020	2,220	461	188
	145	129	....	381	341	784	4,850	419	165
	145	129	....	381	272	1,090	2,130	341	241
	145	129	....	505	241	896	1,620	341	379
	164	129	....	421	241	784	1,460	341	593
	164	129	....	421	272	838	1,380	305	856
	164	129	....	343	241	593	1,460	1,780	639
	164	129	....	343	272	784	2,510	734	548
	188	129	....	421	272	784	1,460	504	461
	217	122	....	343	272	1,160	1,160	461	419
	217	115	....	381	305	896	1,090	419	341
	188	108	....	463	305	784	896	379	272
	251	101	....	421	272	1,020	896	548	288
	217	94	....	421	241	896	734	461	305
	217	87	....	463	241	686	639	461	256
	188	80	....	381	272	639	1,240	379	227
	188	73	....	381	213	593	784	379	241
	188	66	....	343	213	1,240	548	341	227
	164	60	....	550	213	548	593	305	176
	164	54	....	421	241	734	548	272	176
	164	....	....	273	213	1,020	504	272	200
	145	....	....	379	241	838	548	272	194
	145	....	....	269	341	838	504	341	188
	129	....	....	266	1,020	784	419	305	188
	129	....	550	295	1,090	948	1,090	305	200
	129	....	421	260	1,090	896	593	241	200
	129	....	421	256	1,020	784	461	241	165
	129	....	463	285	1,540	1,090	461	213	165
	129	....	381	....	1,780	....	440	241	....

—Shifting control method used Oct. 1 to Nov. 11, Apr. 24 to May 3, May 26 to July 3. Discharge ated Nov. 12-22, and estimated at 50 second-feet Nov. 23-30. No gage readings obtained Nov. 12-21, ec. 1 to Feb. 15, and Feb. 27 to Mar. 7. Chinook winds and ice jams in February and March caused es which reached stage of 15.9 feet on Feb. 21, 22 and 17.2 feet on Mar. 12.

Monthly discharge of Milk River at Havre, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
	251	129	166	10,200
	129	....	92.6	5,510
	550	256	374	22,300
	1,780	213	459	28,200
	1,380	548	889	52,900
	4,850	419	1,160	71,300
	1,780	213	414	25,500
	896	165	300	17,900

MILK RIVER AT MALTA, MONT.

Location.—In NW. ¼ sec. 17, T. 30 N., R. 30 E., at old highway bridge at Malta, in Phillips County.

Drainage area.—Not measured.

Records available.—July 31, 1902, to September 30, 1916.

Gage.—Chain fastened to handrail on downstream side of bridge; read by employees of the United States Reclamation Service.

Discharge measurements.—Made from bridge, or by wading.

Channel and control.—Bed of stream composed of gravel; permanent except for slight shifts at low stages. Partial control at gage at low water, but the principal control is formed by a bar or ridge that produces a riffle considerably below the gage.

Extremes of discharge.—Maximum stage recorded during year, 17.5 feet at 4 p. m. March 19 (discharge estimated from measurement of March 17 at 7,000 second-feet); minimum stage recorded, 1.01 feet April 28–29 (discharge 45 second-feet). Lower flow may have occurred during winter.

1902–1916: Maximum stage recorded, 19.75 feet, April 10, 1907 (discharge 11,200 second-feet); channel reported "dry" August 13 to November 10, 1904; April 24 to May 8, and August 30 to end of year, 1905; April 10, 27–29, May 1, 4–23, 1906; July 16 to December 8, 1910.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Entire run-off from drainage basin above does not pass the station for seven irrigation canals used to irrigate about 25,000 acres of land, divert water from Milk River and its tributaries between Havre and Malta. The United States Reclamation Service has constructed a diversion dam at Dodson, about 17 miles above the station, which will eventually divert water to irrigate about 108,000 acres in Milk River valley. East of Malta two canals are nearing completion, one on each side, the combined capacity being 1,000 second-feet.

Regulation.—Normal distribution of flow affected by storage in Nelson reservoir.

Accuracy.—Stage-discharge relation fairly permanent for open channel but affected by ice during winter. Rating curves used as follows: October 1 to December 18, February 17–19, and March 23–31, well defined; April 1 to September 30, well defined below 300 second-feet and fairly well defined above; February 20 to March 22, curve drawn through measurements made February 25 and March 17 (effect of ice on stage-discharge relation practically constant during this period). Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating tables. Records good.

Discharge measurements of Milk River at Malta, Mont, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 20	W. A. Lamb	[a] 1.79	130	May 19	A. H. Tuttle	1.14	56
Jan. 30	.....do	[b] 2.0	25	29	.....do	4.03	1,280
Feb. 25	.....do	[c] 12.11	3,580	July 24	.....do	3.22	740
Mar. 17	.....do	[d] 16.21	6,140	Aug. 17	.....do	2.91	568
Apr. 11	A. H. Tuttle	3.28	805	22	.....do	2.54	375
May 2	.....do	2.20	255				

[a] Ice along bank, control open.

[b] Measured from ice cover at gage. Channel free from slush and anchor ice. Temperature 40 degrees below zero. No water under gage. Gage height estimated at 2.0 feet.

[c] Stage-discharge relation seriously affected by ice on control. Channel open 400 feet above and below gage.

[d] Stage-discharge relation seriously affected by ice gorge 400 feet below gage.

Daily discharge, in second-feet, of Milk River at Malta, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	210	225	106	....	3,140	4,350	159	1,900	4,290	895	205
	195	210	110	....	3,800	3,380	177	2,100	4,290	825	190
	195	210	127	....	3,060	2,580	177	2,320	4,040	758	164
	195	210	127	....	2,650	2,040	177	2,320	4,040	692	164
	195	195	120	....	2,450	1,620	164	2,180	4,890	630	164
	195	195	120	....	2,180	1,340	164	2,100	5,400	520	137
	195	195	120	....	1,820	1,140	155	1,900	5,220	472	133
	210	195	120	....	1,480	1,070	155	1,760	4,890	448	159
	225	195	120	....	1,340	825	111	1,620	4,230	426	220
	225	195	120	....	1,280	825	114	1,280	3,260	385	346
	225	184	120	....	1,620	758	106	1,340	2,780	346	545
	225	127	120	....	2,250	692	106	1,340	2,720	385	660
	225	132	120	....	4,200	630	79	1,340	2,720	630	520
	241	132	120	....	5,000	600	72	1,410	2,240	660	426
	257	132	120	....	5,250	572	52	1,480	1,820	572	385
	257	132	120	....	6,000	572	52	1,540	1,760	520	346
	291	144	120	254	6,140	600	52	1,680	1,680	520	808
	291	144	120	254	5,900	572	52	1,680	1,680	495	272
	291	144	....	1,960	6,450	572	56	1,620	1,620	472	254
	291	132	....	2,750	6,400	520	56	1,480	1,340	426	220
	307	132	....	3,450	4,500	495	52	1,280	1,480	365	220
	291	132	....	3,530	4,270	495	48	1,070	1,410	346	220
	291	132	....	3,450	4,040	448	48	1,210	1,140	220	205
	274	120	....	3,450	5,220	346	48	1,140	860	96	190
	274	120	....	3,580	5,830	220	57	1,210	825	74	177
	274	120	....	3,530	5,340	83	123	1,410	692	74	164
	257	120	....	3,400	4,410	56	91	1,480	630	101	164
	257	120	....	3,300	3,380	45	164	1,410	600	145	164
	257	120	....	2,680	4,040	45	1,480	1,900	660	190	143
	257	120	....	....	4,650	56	1,900	4,290	1,140	220	143
	241	....	....	....	5,220	....	2,040	....	1,140	205	....

Monthly discharge of Milk River at Malta, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	307	195	246	15,100
November	225	120	155	9,220
December 1-18	127	106	119	4,250
February 17-29	3,580	254	2,740	70,600
March	6,450	1,280	3,980	245,000
April	4,350	45	918	54,600
May	2,040	48	267	16,400
June	4,290	1,070	1,690	101,000
July	5,400	600	2,440	150,000
August	895	74	423	26,000
September	660	137	253	15,100

MILK RIVER NEAR VANDALIA, MONT.

Location.—In sec. 7, T. 30 N., R. 37 E., at Vandalia dam of United States Reclamation Service, 2 miles west of Vandalia, in Valley County.

Drainage area.—Not measured.

Records available.—May 5, 1915, to September 30, 1916. Records were obtained at Hinsdale, 6 miles upstream, May 13, 1908, to November 13, 1914; discharge nearly the same at both points.

Gage.—Sloping gage painted on concrete of right abutment, downstream side of dam; read by employees of United States Reclamation Service.

Discharge measurements.—Made by wading or from bridge at Vandalia, 2 miles below; distance along river probably 4 miles.

Channel and control.—Water surface in large pool below dam is controlled by a gravel bar which is drowned out at medium and high stages, when the river bed below forms the control.

Extremes of stage.—During the ice jam of March 14–21, the water was over the abutment, approximate height on gage 32.0 feet (discharge not known). For open channel the maximum gage height was 30.0 feet at 4 p. m., March 24; minimum stage, 4.0 feet January 20 to February 22 (discharge, 114 second-feet).

1908–1916: Maximum stage recorded April 6, 1912 (discharge estimated at 24,200 second-feet); channel reported dry August 9–13, 1910.

Ice.—Stage-discharge relation seriously affected by ice for short periods.

Diversions.—During the irrigation season water is diverted from the main stream above station and from nearly all of its tributaries.

Regulation.—Flow regulated to some extent by various diversion dams and by small reservoirs on tributaries.

Accuracy.—Stage-discharge relation not permanent. Rating curves used as follows: October 1 to February 22, except November 20 to December 2, curve fairly well defined; April 6 to July 31, curve fairly well defined below 8,400 second-feet; August 1 to September 30, curve well defined between 80 and 600 second-feet. Stage-discharge relation affected by ice November 20 to December 2 and by débris in channel and ice jams from February 23 to April 5. Gage read twice daily to tenths. Determinations of mean daily gage height may be subject to error due to variations in sluice-gate openings. Gage readings closer than tenths are difficult to make. Daily discharge ascertained by applying mean daily gage height to rating tables except for periods during which stage-discharge relation was affected by ice or by débris in channel. Records fair.

Discharge measurements of Milk River near Vandalia, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 21	W. A. Lamb	4.3	154	May 18	A. H. Tuttle	4.8	267
Mar. 18	....do	([a])	422	June 20[b]	....do	8.6	1,770
Apr. 12[b]	A. H. Tuttle	21.0	8,320	July 25[b]	....do	7.8	1,440
30[b]	....do	5.95	668	Aug 21[b]	....do	5.6	437

[a] Ice jam, gage submerged. [b] Measured at bridge at Vandalia.

Daily discharge, in second-feet, of Milk River near Vandalia, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	267	428	145	147	114	......	......	272	2,430	7,390	1,820	269
2	253	428	145	147	114	......	......	330	2,430	8,090	1,290	300
3	253	362	147	147	114	......	......	460	2,430	7,450	1,040	300
4	297	297	147	147	114	......	......	495	2,430	5,960	994	300
5	297	297	147	147	114	......	......	495	3,020	5,300	716	240
6	267	297	147	147	114	......	9,020	495	3,020	6,070	606	240
7	213	267	147	147	114	......	7,920	495	2,820	7,220	606	240
8	213	297	147	147	114	......	6,870	495	2,480	8,260	570	213
9	253	297	147	147	114	......	5,630	460	2,190	8,840	500	213
10	239	239	147	147	114	......	5,090	460	1,950	7,800	500	226
11	267	213	147	147	114	......	6,520	393	1,950	6,760	500	365
12	239	189	147	147	114	......	8,500	300	1,720	5,630	500	432
13	213	189	147	147	114	......	9,080	300	1,500	4,770	432	432
14	253	189	147	147	114	......	10,400	216	1,500	4,250	432	500
15	267	189	147	147	114	......	8,030	216	1,500	3,520	535	432
16	346	189	147	129	114	......	5,960	32	1,630	2,720	570	398
17	428	189	147	129	114	......	5,090	32	1,630	2,330	570	365
18	395	189	147	129	114	422	4,040	203	1,680	2,870	466	332
19	395	157	147	129	114	......	2,970	190	1,680	1,330	432	332
20	395	155	147	114	114	......	2,290	203	1,720	836	432	300
21	428	154	147	114	114	......	1,950	203	1,860	1,370	432	269
22	428	145	147	114	114	......	1,630	190	1,860	1,680	398	240
23	532	145	147	114	......	......	1,460	165	1,770	1,860	398	240
24	532	145	147	114	......	......	1,420	216	1,680	1,770	365	226
25	496	145	147	114	......	......	1,250	272	1,590	1,420	332	200
26	496	145	147	114	......	......	797	1,590	1,680	1,250	300	188
27	532	145	147	114	......	......	603	1,590	1,720	996	240	188
28	496	145	147	114	......	......	460	996	2,050	530	213	200
29	496	145	147	114	......	......	330	955	2,820	915	165	240
30	496	145	147	114	......	......	460	875	4,720	2,050	144	144
31	462	......	147	114	......	......	......	2,000	......	2,140	200	......

Note.—Discharge, Nov. 20 to Dec. 2, estimated because of ice. Ice jams and débris on control Feb. 23 to Apr. 5; discharge not determined. Gage readings not obtained Mar. 14–21, as water was backed over abutment by ice jam.

ischarge of Milk River near Vandalia, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]	532	213	359	22,100
[illegible]	428	145	217	12,900
[illegible]	147	145	147	9,040
[illegible]	147	114	132	8,120
[illegible] 1-22	114	114	114	4,970
[illegible]-30	10,400	330	4,310	214,000
[illegible]	2,000	32	503	30,900
[illegible]	4,720	1,500	2,120	126,000
[illegible]	8,840	530	3,960	245,000
[illegible]	1,820	144	539	33,100
[illegible]	500	144	285	17,000

NORTH FORK OF MILK RIVER NEAR KIMBALL, ALBERTA.

[illegible].—In NE. ¼ sec. 11, T. 1, R. 23 W. fourth meridian, Alberta, about 300 ards above road crossing at Peter's ranch, 18 miles east of Kimball, and about iles north of international boundary.

AINAGE AREA.—101 square miles (measured on topographic maps).

DS AVAILABLE.—January 1, 1913, to September 30, 1916. July 21, 1909, to ecember 31, 1912, station was maintained by Irrigation Branch, Department the Interior, Canada, in NE. ¼ sec. 13, T. 1, R. 23 W. fourth meridian, about 2 iles downstream; May 8, 1911, to December 31, 1912, station was maintained Alexander Dubray's ranch, 2 miles south of international boundary.

E.—Stevens water-stage recorder on left bank, inspected by William Wheeler.

HARGE MEASUREMENTS.—Made by wading or from a footbridge 700 feet below ge.

NEL AND CONTROL.—Bed of the stream at gage and principal control composed f clay and small boulders; slightly shifting. Banks high and not subject to overw at ordinary high stages.

EMES OF DISCHARGE.—Maximum stage recorded during year, due to ice jams, .35 feet February 17; maximum discharge, 405 second-feet at 7 a. m. June 28 age height 4.06 feet by water-stage recorder); minimum stage recorded, 1.97 feet December 7; minimum discharge, 5.0 second-feet February 12 (gage height 3.45 feet, stage-discharge relation affected by ice).

1909–1916: Maximum stage recorded, 3.9 feet (at station maintained by Canada; see paragraph on "Records available") July 27, 28, 1909 (discharge, 591 secondfeet); minimum stage, 1.97 feet December 7, 1915; minimum discharge, that of February 12, 1916.

.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, temperature records, and observer's notes.

RSIONS.—The St. Mary canal intercepts the flow of several small streams in t. Mary basin and delivers the water to the North Fork of Milk River. According to engineers of the United States Reclamation Service, approximately 1,528 acre-feet of water was added to the flow of North Fork of Milk River above the gaging station from this source during 1916.

LATION.—None.

RACY.—Stage-discharge relation changed during periods of high water and ice. Rating curves used as follows: October 1 to November 10, well defined between 24 and 160 second-feet; April 26 to May 24 and June 27 to August 19, fairly well defined between 50 and 270 second-feet. Mean gage height for October 1 to December 19, April 6 to May 16, and May 31 to September 30 found by inspecting recorder graph. Outside staff gage read once daily to hundredths January 1 to April 5 and May 17–30. No gage heights obtained December 20–31. Daily discharge ascertained by applying daily gage height to rating tables except for periods during which stage-discharge relation was affected by shifting control or ice. Records good.

Cooperation.—Station maintained in cooperation with and computations made by the Irrigation Branch, Department of the Interior, Canada.

Discharge measurements of North Fork of Milk River near Kimball, Alberta, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	V. A. Newhall [a]	2.34	84	June 11	A. H. Tuttle	2.90	182
Nov. 11	W. H. Storey [a]	2.43	39	21	S. H. Frame	2.44	103
Dec. 6	do	2.06	56	27	A. H. Tuttle	2.50	104
7	do	1.97	44	27	S. H. Frame	2.47	120
23	do	2.02	40	28	do	3.32	267
Jan. 11	do	3.09	32	July 19	W. A. Lamb	2.23	72
Feb. 11	V. A. Newhall	3.57	[b] 5.5	23	S. H. Frame	2.13	62
Mar. 2	do	3.11	36	Aug. 19	V. A. Newhall	2.38	92
16	S. H. Frame [a]	2.45	91	Sept. 5	S. H. Frame	2.38	101
Apr. 6	do	2.30	74	6	do	2.28	80
25	do	2.07	58	7	do	2.21	71
26	W. A. Lamb	2.10	55	7	do	2.27	73
May 24	Tuttle and Lamb	2.45	106	27	do	2.19	59
31	S. H. Frame	2.45	99	28	do	2.14	52
June 1	do	2.84	180				

[a] Engineer Irrigation Branch, Department of Interior, Canada. [b] Discharge estimated.

Daily discharge, in second-feet, of North Fork of Milk River near Kimball, Alberta, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	59	65	36	34	18.3	36	81	74	158	102	56	78
2	59	65	46	34	16.6	36	80	88	145	93	56	78
3	89	65	51	34	15.0	37	83	74	96	96	56	170
4	90	66	54	33	13.6	40	63	63	84	86	57	230
5	86	66	58	33	12.0	43	57	62	149	78	61	122
6	86	67	56	33	10.4	46	74	56	159	76	58	82
7	89	66	43	33	9.0	51	80	55	102	74	58	76
8	92	65	43	33	8.0	64	81	53	88	78	64	75
9	78	66	40	32	7.0	83	90	51	84	78	158	72
10	75	58	36	32	6.1	104	96	47	148	71	137	74
11	80	39	36	32	5.5	123	90	47	169	64	104	67
12	87	38	35	32	5	144	100	53	101	64	83	63
13	81	37	35	32	10	164	103	55	84	66	100	67
14	80	46	35	32	80	189	91	56	82	64	95	79
15	87	48	34	31	150	154	73	50	75	60	74	75
16	76	58	33	31	700	91	86	61	73	57	70	70
17	71	50	35	31	600	82	85	51	71	64	82	65
18	67	56	38	31	400	58	82	50	68	76	134	63
19	65	58	36	30	200	80	81	49	80	74	93	61
20	65	36	36	31	180	102	73	50	88	70	80	59
21	65	34	36	32	170	100	66	48	100	64	80	59
22	65	32	38	34	160	76	68	45	110	62	79	57
23	65	54	40	35	150	62	65	70	125	58	77	57
24	64	50	40	34	140	54	61	106	80	62	82	55
25	64	35	40	32	115	53	58	166	90	66	86	50
26	64	46	40	30	80	61	56	225	94	74	87	51
27	65	46	40	29	55	68	128	178	108	104	83	58
28	65	46	39	27	45	57	130	140	241	78	82	53
29	65	42	38	25	38	48	55	158	214	61	82	52
30	66	39	36	22	......	50	54	175	162	55	84	51
31	65	......	35	20	......	65	......	99	......	55	80	......

Note.—Discharge Mar. 14 to Apr. 25, May 25 to June 26, and Aug. 25 to Sept. 30, computed by shifting-control method. Discharge Nov. 11 to Mar. 13, estimated, because of ice, from gage heights, discharge measurements, and weather records. Discharge interpolated May 25 and 29. See "Accuracy" in description of station.

charge of North Fork of Milk River near Kimball, Alberta, for the year ending Sept. 30, 1916.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]	92	59	73.4	4,510
[illegible]	67	32	51.3	3,050
[illegible]	58	33	39.9	2,450
[illegible]	35	20	31.1	1,910
[illegible]	700	5.0	117	6,730
[illegible]	189	36	78	4,800
[illegible]	130	54	79.7	4,740
[illegible]	225	45	82.4	5,070
[illegible]	241	68	114	6,780
[illegible]	104	55	71.9	4,420
[illegible]	158	56	83.2	5,120
[illegible]	230	50	75.6	4,500
The year	700	5.0	74.6	54,100

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

ATION.—In SE. ¼ sec. 20, T. 33 N., R. 18 E., at highway bridge half a mile below headgates of canal on Milk River 8 miles west of Chinook, in Blaine County.

RDS AVAILABLE.—June 21, 1903, to September 30, 1916.

GE.—Vertical staff on downstream side of first bent of piles from left bank; used since 1910; read by E. O. Walters. Gage previously used was a vertical staff, at a different datum, at the highway bridge one-fourth mile downstream. Both bridge and gage were washed out by high water of June, 1908, and new gage was installed June 27, 1908, at a different datum, within a few feet of site of old gage. Discharge is the same at all three sites.

CHARGE MEASUREMENTS.—Made by wading at section about 30 feet below gage.

ANNEL AND CONTROL.—Channel soil, no definite control. Some backwater is caused by a check weir about half a mile below gage, and by aquatic plants that grow in the canal during summer. The water is muddy and deposits silt. Current uniformly sluggish at low stages.

RACY.—Stage-discharge relation not permanent; affected by shifting control, backwater from checks half a mile below, and by growth of aquatic plants. Rating curves applicable as follows: April 6 to May 17, well defined; May 23 to June 10, and June 16 to July 1, poorly defined; July 19 to September 30, fairly well defined. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage height to rating tables except for periods during which stage-discharge relation was affected by shifting control. Records fair.

The water in the Fort Belknap canal is diverted fron the north bank of Milk River in SE. ¼ sec. 20, T. 33 N., R. 18 E., to irrigate lands on the north side of the river. of that diverted is used, but it can be wasted into Lodge Creek, north of Chinook, 5 miles below the head gate. Check gates erected on the main canal to divert into the laterals often back the water for long distances. As the gates are put up a great variety of conditions velocities differ widely at the same gage height the season.

charge measurements of Fort Belknap canal near Chinook, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
[illegible]	1.82	26.5	May 28	2.12	35.9	July 19	1.65	7.8
[illegible]	2.12	41.5	June 16	2.50	40.0	Aug. 15	1.78	12.6

Daily discharge, in second-feet, of Fort Belknap canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	22	41	21	13	13	16	6.2	49	39	1.4	9.5	9.5
2	....	18	47	11	13	13	17	18	52	38	1.4	13	9.5
3	....	18	58	11	13	13	18	20	63	35	6.2	15	8.0
4	....	26	58	11	13	13	19	22	67	35	8.0	17	8.0
5	....	26	58	6.2	13	13	20	24	65	43	6.5	19	8.0
6	....	28	58	2.8	13	25	21	26	70	43	6.5	14	8.0
7	....	26	64	2.8	13	25	22	26	63	38	9.5	9.5	8.0
8	....	30	61	2.8	13	25	23	26	49	38	9.5	9.5	8.0
9	....	30	58	2.8	13	25	24	26	46	38	13	9.5	8.0
10	....	30	64	2.8	13	25	25	26	46	30	17	11	8.0
11	....	35	38	2.8	13	21	26	26	46	30	17	11	8.0
12	....	40	26	2.8	13	21	27	26	46	30	9.5	13	8.0
13	....	41	33	1.4	6.5	9.5	28	26	38	30	9.5	13	8.0
14	....	52	38	1.4	6.5	9.5	29	26	41	22	9.5	13	8.0
15	....	49	40	1.4	11	9.5	30	22	41	22	13	13	8.0
							31	....	47	....	13	13	....

NOTE.—Head gates opened Apr. 16. Discharge May 18-22, June 11-15, and July 2-18 computed by shifting-control method.

Monthly discharge of Fort Belknap canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 16-30	26	6.2	23.1	687
May	70	18	41.9	2,580
June	64	22	41.8	2,490
July	21	1.4	7.56	465
August	19	6.5	12.4	762
September	25	8.0	12.8	762
The period	....	....	....	7,750

BATTLE CREEK NEAR CHINOOK, MONT.

LOCATION.—In sec. 3, T. 33 N., R. 19 E., 500 feet above new highway bridge about 4½ miles north of Chinook, in Blaine County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 22, 1905, to September 30, 1916.

GAGE.—Low-water gage is overhanging chain on the left bank, near the house of R. B. Snedecor and 500 feet above the highway bridge; high-water gage is vertical staff at same point. Gages read by Mrs. R. B. Snedecor.

DISCHARGE MEASUREMENTS.—Made by wading or from the highway bridge.

CHANNEL AND CONTROL.—Bed of stream gravel and sand. Banks high; not subject to overflow. Low-water control is a sand bar below the gage; no definite point of control at high water.

EXCHANGE OF DISCHARGE.—Maximum stage recorded during year, 11.50 feet at 5 p. m. March 28 (discharge, determined from extension of rating curve, 3,860 second-feet); minimum stage recorded, 0.8 foot October 1-2, 26-28, 1915 (discharge, 23 second-feet).

1905-1916: Maximum stage recorded, 12.60 feet, June 8, 1906 (discharge, 4,600 second-feet); no flow September 3 to October 22, 1905; July 8 to November 20, 1908; June 21 to end of year, 1910; July 22 to September 3, 1911; September 7-23, 1913; July 14 to October 4, 1914.

ICE.—Discharge relation seriously affected by ice. Observations discontinued during the winter.

DIVERSIONS.—Fifteen ditches divert water from this creek in Canada before it crosses the boundary line. Three canals, which divert in the aggregate about 20 second-feet, take out above the station in the United States. Several small pumping plants, which supply water for irrigating the bottom land along the valley, also operate above the station. Below the station Matheson and Cook canals divert water (see pp. 88, 89) for irrigating land in Milk River Valley near the mouth of Battle Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; seriously affected by ice November 21 to March 12. Two rating curves used, one applicable October 1 to November 20, March 13 to April 14, and June 4 to September 30, well defined below 700 second-feet and poorly defined above; the other, applicable April 24 to June 3, well defined between 40 and 700 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating tables, except for periods during which stage-discharge relation was affected by shifting control, for which periods records are fair. Records obtained by use of rating tables good.

Discharge measurements of Battle Creek near Chinook, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
[illegible]	A. H. Tuttle	2.05	172	July 26	A. H. Tuttle	1.28	69
[illegible]	do	1.62	102	Aug. 15	do	1.45	95
[illegible] 4	do	1.38	71	22	do	1.04	48.1
[illegible]	do	4.22	637	Sept. 10	Wm. A. Lamb	1.06	47.0
[illegible]	do	1.40	89				

Daily discharge, in second-feet, of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	23	25		1,350	73	554	235	109	46
	23	25		1,230	73	740	158	74	45
	24	25		640	73	920	207	59	45
	25	25		485	73	515	870	50	48
	25	25		319	68	364	255	47	51
	25	28		245	68	297	675	47	48
	25	28		216	68	255	545	43	46
	25	28		198	68	226	216	41	44
	25	28		181	68	319	158	80	47
	25	28		165	68	575	122	97	47
	28	28		150	68	255	109	85	45
	30	28		173	68	190	85	80	47
	32	28	2,100	165	68	181	63	80	47
	32	28	1,350	165	68	216	91	80	44
	32	28	1,350	157	68	460	85	85	41
	32	28	1,670	156	68	435	74	74	38
	32	28	1,190	155	68	297	68	63	37
	32	28	790	146	62	235	68	58	36
	34	28	341	137	62	181	216	51	34
	34	28	460	130	57	173	226	48	34
	34		2,190	128	57	158	150	46	33
	37		3,220	120	57	150	122	44	32
	37		2,780	113	57	143	103	41	32
	31		1,830	103	62	136	97	40	32
	27		1,510	97	123	129	80	44	32
	23		1,630	85	376	129	74	47	32
	23		3,220	79	670	150	74	46	32
	23		3,720	73	640	136	74	44	32
	25		2,780	73	502	136	80	41	33
	25		2,730	73	376	165	85	40	34
	25		1,830		845		122	42	

NOTE.—Discharge Apr. 15-23 determined by shifting-control method. No gage readings obtained [illegible] Mar. 12.

Monthly discharge of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	37	23	28.2	1,730
November 1-20	28	25	27.2	1,080
March 13-31	3,720	341	1,930	72,700
April	1,350	73	250	14,900
May	845	57	165	10,100
June	920	129	294	17,500
July	870	63	180	11,100
August	109	40	58.9	3,620
September	51	32	39.8	2,370

COOK CANAL NEAR CHINOOK, MONT.

Location.—In N. ½ sec. 30, T. 33 N., R. 20 E., about half a mile above small wooden highway bridge on road running parallel to Great Northern Railway, half a mile below headgates, and 3 miles east of Chinook, in Blaine County.

Records available.—April 10, 1905, to September 30, 1916 (irrigation season only).

Gage.—Vertical staff on left bank, about 1,000 feet above point at which canal turns and runs parallel with the road; read by Adam Jamison.

Discharge measurements.—Made by wading where canal passes under the Great Northern Railway.

Channel and control.—Channel of earth; no well-defined control. Weeds grow along the bottom, causing backwater. Canal infested with beavers, whose dams are liable to cause backwater.

Accuracy.—Stage-discharge relation not permanent, affected by shifting control and aquatic growth in channel. Gage read to hundredths once daily. Daily discharge obtained by shifting-control method throughout season. Standard rating curve fairly well defined below 30 second-feet. Records fair.

Cook Canal diverts water from Battle Creek in SE. ¼ sec. 19, T. 33 N., R. 20 E., to irrigate lands in Milk River valley on south side of river. Canal crosses Milk River in a flume. Water can be wasted into Milk River at this flume, which is about 2 miles below the gage. Little water is returned to the stream intentionally, but the flume often acts as a throttle when too much water is turned in at the headgate.

Discharge measurements of Cook canal near Chinook, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 14	....	Dry.	May 28	1.44	3.1	June 16	3.15	21.5
May 3	2.37	15.5	June 16	3.15	21.3	July 19	1.90	7.3
14	3.30	28.1						

Daily discharge, in second-feet, of Cook canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	......	......	28	28	19	3.1
2	......	......	16	2.8	21	3.0
3	......	......	15	35	21	3.1
4	......	......	16	6.4	21	4.3
5	......	......	28	10	16	4.6
6	......	......	32	11	13	4.3
7	......	......	30	7.2	9.9	3.8
8	......	......	28	6.5	5.8	2.2
9	......	......	28	6.5	4.4	.5
10	......	......	28	6.5	2.8	.5
11	......	......	24	7.5	1.8	.5
12	......	......	23	13	4.6	......
13	......	......	24	14	3.8	......
14	......	......	28	18	2.0	......
15	......	......	25	12	1.5	......
16	......	......	26	21	1.3	......
17	......	......	25	18	1.2	......
18	......	......	25	15	1.1	......
19	......	......	26	18	7.3	......
20	......	......	26	25	5.5	......
21	......	......	28	21	3.1	......
22	......	......	28	20	2.6	......
23	......	......	28	28	3.5	......
24	......	13	28	32	4.5	......
25	......	16	22	30	2.5	......
26	......	31	16	29	2.2	......
27	18	32	10	27	2.1	......
28	33	30	3.1	25	1.8	......
29	19	28	1.3	23	1.2	......
30	9	28	1.1	20	.9	......
31	2	......	20	......	3.3	......

Note.—Head gates open Mar. 27 to Apr. 1 and Apr. 24 to Aug. 11.

Monthly discharge of Cook canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 27–31	33	2	16.2	161
April	32	0	5.93	353
May	32	1.1	22.1	1,360
June	35	2.8	17.9	1,070
July	21	.9	6.18	380
August 1–11	4.6	.5	2.72	59
The period	......	......	......	3,380

MATHESON CANAL NEAR CHINOOK, MONT.

Location.—In NW. ¼ sec. 29, T. 33 N., R. 20 E., at highway bridge over head gate of canal, one-fourth mile north of main road, and 3½ miles east of Chinook, in Blaine County.

Records available.—April 10, 1905, to September 30, 1916 (irrigation seasons only).

Gage.—Vertical staff nailed to a post on the right bank, about 10 feet below head gate of canal; read by Adam Jamison.

Discharge measurements.—Made by wading below gage.

Channel and control.—Bed of the canal is mud. No definite point of control. Weeds grow in the bottom of the canal during the summer months.

Regulation.—Flow regulated by head gate; depends also on height of diversion dam. The dam was washed out in June, 1916, and was not replaced.

Accuracy.—Stage-discharge relation probably permanent during June and July, 1916. Rating curves poorly defined. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records poor.

Matheson canal diverts water from Battle Creek for the irrigation of lands on the north side of Milk River valley. Water can be wasted into a small tributary of Milk River. Practically all water diverted during 1916 was merely overflow from Battle Creek during the high stages.

The following discharge measurement was made by A. H. Tuttle:

June 16, 1916: Gage height, 3.50 feet; discharge, 0.9 second-foot.

Daily discharge, in second-feet, of Matheson canal near Chinook, Mont., for the year endin Sept. 30, 1916.

Day.	Mar.	June.	July.	Aug.	Day.	Mar.	June.	July.	Aug.
1		3.8	12.7	1.5	16		.8	.0	
2		8.9	2.7		17		.0	.0	
3		11.7	2.2		18		.0	.0	
4		5.7	1.7		19		.0	.0	
5		.6	1.6		20		5.0	.0	
6		.0	1.4		21		8.1	.0	
7		.0	2.2		22		8.1	.0	
8		.0	1.1		23		7.4	.0	
9		1.6	.5		24		7.0	.0	
10		1.7	.0		25		5.9	.0	
11		.6	.0		26		5.7	.0	
12		.5	.0		27	2.3	7.2	.7	
13		.5	.0		28	3.3	5.5	.6	
14		9.6	.0		29	4.3	8.5	1.1	
15		2.3	.0		30	1.6	5.9	2.3	
					31			1.0	

NOTE.—Canal dry Apr. 1 to May 31, 1916, June 7, 8, 17–19, July 10–26, and Aug. 2 to Sept. 30, 1916. Water in canal represents overflow from Battle Creek through gates, as canal was not used for irrigation during 1916.

Monthly discharge of Matheson canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 27–31	4.3	0	2.30	22.8
June	11.7	0	4.09	243
July	12.7	0	1.03	63.3

PARADISE VALLEY CANAL NEAR CHINOOK, MONT.

LOCATION.—In SW. ¼ sec. 35, T. 33 N., R. 20 E., about 300 feet below intake on Milk River, near house of Rudolph Friede, 6 miles southeast of Chinook, in Blaine County.

RECORDS AVAILABLE.—June, 1903, to September 30, 1916.

GAGE.—Vertical staff on left bank, 300 feet below head gate and 30 feet below Cook canal flume over Paradise Valley canal; read by Rudolph Friede, ditch rider.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed of canal earth; silt is deposited during the irrigation season. Weeds grow in the bottom of the canal during the summer months. A large slough into which the canal flows, a few hundred feet below the gage, may affect results, the height of the water in the slough possibly affecting the slope of the water surface at the gage.

REGULATION.—Flow partly regulated by intake gates which are low and permit overflow from river at high stages.

ACCURACY.—Stage-discharge relation not permanent, owing to silting up of canal by mud from river. Discharge measurements subject to some error due to difficulty in accurately determining the depth on account of soft mud in bottom. Rating curves fairly well defined April 26 to May 6, May 23 to July 7, and July 19–31. Gage read to hundredths twice daily. Discharge ascertained by applying mean gage height to rating tables or, for intervals between curves, by shifting-control method. Records fair.

Paradise Valley canal diverts water from the south bank of Milk River in the SW. ¼ sec. 35, T. 33 N., R. 20 E., for irrigation of lands on south side of river. No water is returned to the river.

Discharge measurements of Paradise Valley canal near Chinook, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
14		(1)	May 28	2.17	9.7	July 19	2.00	3.3
	1.58	5.3	June 16	1.84	4.8	Aug 15		(1)
14	1.78	7.3						

[1] Dry.

Daily discharge, in second-feet, of Paradise Valley canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
		6.7	10.5	3.6	16		7.2	4.8	0.0
		6.5	11.0	3.7	17		7.5	3.8	.0
		5.5	11.2	4.1	18		7.8	2.9	.0
4		5.6	10.8	4.2	19		7.9	2.1	5.8
		5.6	8.9	2.3	20		8.3	1.5	1.5
		5.3	8.9	3.0	21		7.8	2.6	.0
		4.4	9.3	3.1	22		7.3	1.1	.0
		6.0	8.6	1.3	23		7.6	2.0	.0
		6.2	8.9	1.0	24		8.2	2.9	.0
		6.1	8.9	.8	25		9.1	2.2	.0
		6.1	7.2	.7	26	0.4	11.7	2.2	.0
		7.3	7.7	.3	27	7.6	7.8	2.8	2.9
		8.0	7.6	.1	28	6.9	10.3	3.0	4.3
		7.5	7.4	.0	29	6.7	8.4	5.0	.0
		7.2	8.6	.1	30	8.2	10.0	3.8	.0
					31		10.3		.0

NOTE.—No flow before April 26 and after July 31.

Monthly discharge of Paradise Valley canal near Chinook, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
30	8.2	0.4	5.96	59
	11.7	4.4	7.46	459
	11.2	1.1	5.94	353
	5.8	.0	1.38	85
The period				956

HARLEM CANAL NEAR ZURICH, MONT.

LOCATION.—In SW. ¼ sec. 33, T. 33 N., R. 21 E., 500 feet below head gates of canal 1½ miles southeast of Zurich, in Blaine County.

RECORDS AVAILABLE.—June, 1903, to September 30, 1916.

GAGE.—Vertical staff nailed to tree on right bank about 500 feet below head gates; read by B. E. Hemphill.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed of canal is mud. No definite point of control. Checks several miles below the gage may cause some backwater at the higher stages. Weeds growing in the canal during the irrigation season also cause backwater, and much silt is deposited.

Regulation.—Flow regulated by head gate 500 feet above gage.

Accuracy.—Stage-discharge relation fairly permanent except for period April 7 to May 14. Fairly well defined rating curve used, applicable March 31 to April 26 and May 13 to July 8. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used April 27 to May 12. Records fair.

Harlem canal diverts water from north bank of Milk River in the SW. ¼ sec. 33, T. 33 N., R. 21 E., for irrigation of lands on north side of river near Harlem. Water can be wasted into Milk River, but most of that diverted is used.

Discharge measurements of Harlem canal near Zurich, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 25	3.25	48.7	May 14	3.24	47.3
May 3	3.60	57	June 16	2.48	24.7

Daily discharge, in second-feet, of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1		6.9	55	40	5.3	16		40	48	26	
2		26	61	40	4.0	17		46	48	3.3	
3		30	57	40	3.6	18		60	48	3.3	
4		19	57	40	3.8	19		55	48	10	
5		29	59	42	3.3	20		49	53	9.6	
6		20	58	33	3.6	21		48	53	9.5	
7		32	59	0	3.0	22		48	49	9.1	
8		30	55	30	2.4	23		50	51	9.4	
9		27	44	32		24		51	52	9.6	
10		26	44	34		25		44	44	8.8	
11		29	50	33		26		36	37	8.9	
12		32	46	33		27		47	36	8.7	
13		34	45	33		28		59	36	6.9	
14		39	49	32		29		54	31	6.3	
15		41	49	31		30		53	32	6.5	
						31	8.2		38		

Note.—Head gates opened Mar. 31 and closed July 8.

Monthly discharge of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1918.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	60	6.9	38.7	2,300
May	61	31	48.1	2,960
June	42	.0	21.0	1,250
July 1-8	5.3	2.4	3.62	57
The period				6,560

AGENCY DITCH NEAR HARLEM, MONT.

CATION.—In NW. ¼ SW. ¼ sec. 33, T. 32 N., R. 23 E., at spillway about 1,000 feet below highway bridge, and about half a mile below head gates, on Fort Belknap Reservation, 4 miles south of Harlem, in Blaine County.

ORDS AVAILABLE.—July 14, 1905, to September 30, 1916. (Irrigation seasons only.)

E.—Vertical staff on right bank, on downstream side of the check at the spillway. Read by Phil H. Marrion.

SCHARGE MEASUREMENTS.—Made from highway bridge 1,000 feet above the gage

ANNEL AND CONTROL.—Bed of ditch is mud and is subject to sudden changes when head on ditch is changed. A check about a mile below causes considerable backwater, which varies with the quantity of water diverted.

GULATION.—Flow regulated at intake by head gates.

CURACY.—Stage-discharge relation affected by changes in channel and operation of check 1 mile below. Rating curves used as follows: April 6 to May 5, and June 5 to July 4, well defined between 18 and 110 second-feet; May 6–19, fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table except for period during which stage-discharge relation was affected by shifting control. Records good for period April 6 to May 5; fair for other periods.

ency ditch takes water from the south bank of Milk River in sec. 32, T. 32 N., 23 E., for the irrigation of lands on the Fort Belknap Indian Reservation. er not required for irrigation can be wasted into White Bear Creek, about 12 s below head gate. The canal has been given a prior right by court decrees to 125 d-feet of the water of Milk River and tributaries above the point of diversion.

charge measurements of Agency ditch near Harlem, Mont., during the year ending Sept. 30, 1916.

te.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
2	Tuttle and Marrion[a]	3.98	54	June 4	Phil. H. Marrion	4.15	63
14	A. H. Tuttle	4.19	44	21	Tuttle and Marrion	4.98	98
21	Phil. H. Marrion	3.55	51	21	Marrion and Tutle	4.98	99
27	do	5.10	110	July 1	Phil. H. Marrion	3.10	21.6

[a] Engineer, United States Indian Service.

[b] Check gate in place one mile below.

ly discharge, in second-feet, of Agency ditch near Harlem, Mont., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		56	86	22	16	59	47	0	
		55	62	1	17	55	47	0	
		59	63	1	18	47	45	0	
4		60	62	0	19	43	44	0	
		60	0		20	0	64	90	
	78	48	0		21	0	50	94	
	75	50	78		22	66	57	96	
	70	49	84		23	67	64	90	
	67	52	86		24	73	70	95	
	61	56	86		25	80	73	92	
	53	53	0		26	63	78	90	
	47	57	0		27	53	106	90	
	51	53	0		28	57	128	98	
	59	49	0		29	57	98	94	
	60	49	0		30	57	86	62	
					31		92		

E.—May 6–19 gage heights affected by backwater from check about a mile below gage; discharge ned from curve through one measurement made during this period. Discharge May 20 to June 4 ned by shifting-control method. No flow in canal before Apr. 6, on Apr. 20-21, June 5–6 and 9, and after July 3.

Monthly discharge of Agency ditch near Harlem, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 6-30	80	0	55.9	2,770
May	128	44	63.1	3,880
June	98	0	53.3	3,170
July 1-4	22	0	6.0	48
The period				9,870

ROCK CREEK NEAR HINSDALE, MONT.

Location.—In sec. 10, T. 31 N., R. 36 E., at Ottenstror's ranch, about 2 miles below head gates of Rock Creek canal and 6 miles northeast of Hinsdale, in Valley County.

Drainage area.—Nor measured.

Records available.—April 19, 1912, to September 30, 1916. From July 5, 1905, to December 31, 1907, records were obtained at a station 2 miles upstream, just below the diversion dam of the Rock Creek canal. Flow at these two points is practically the same.

Gage.—Overhanging chain gage and staff gage on the left bank, back of John Ottenstror's house; chain gage reads to 16.0 feet; staff 16.0-24.0 feet. Gage read by Mrs. John Ottenstror.

Discharge measurements.—Made by wading one-fourth mile below the gage at low and medium stages, and from a bridge 2 miles below at high stages.

Channel and control.—The water at the gage is deep and sluggish at low water. Control is a gravel bar a quarter of a mile below; under natural conditions it shifts a little at high water. Left bank is high and not subject to overflow at the gage; right bank fairly high, but subject to overflow at flood stages.

Extremes of discharge.—Maximum stage recorded during year, 20.6 feet at 2 p. m. April 13 (discharge, 4,220 second-feet); minimum discharge, 3.7 second-feet, November 21, 1915. Lower flow may have occurred during winter.

1906-1907 and 1912-1916: Maximum stage recorded, 18.40 feet June 9, 1906; measured by leveling from flood marks (discharge, determined from extension of rating curve, about 6,220 second-feet); no flow April 14 to May 2, 9-24, and after July 12, 1906; after September 28, 1907; April 23-25, 27, 28, 30, May 1, 2, and 4, 1913; May 3, 5, 8, 10, and 13, 1915.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter months.

Diversions.—There is no storage, but the normal summer flow is appropriated and used during the irrigation season.

Regulation.—None.

Accuracy.—Stage-discharge relation seriously affected by backwater from a beaver dam from October 1 to the time of spring flood, which carried the dam away; discharge for this period not determined; stage-discharge relation for other periods fairly permanent. Two rating curves, well defined at low and fairly well defined at high stages, were used, one applicable March 20 to June 3, the other June 18 to September 30. Gage read to nearest half tenths once daily. Discharge ascertained by applying gage height to rating table; shifting-control method used June 4-17. Records good except those for intermediate stages, which are fair, owing to possible reversal in curve between 7 and 18 feet.

Discharge measurements of Rock Creek near Hinsdale, Mont., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 21[a]	W. A. Lamb	6.70	3.7	May 29[b]	A. H. Tuttle	6.50	175
Apr. 12[b]	A. H. Tuttle	18.95	3,670	June 19	do	5.74	24.0
30	do	6.06	90	July 25	do	5.65	13.3
May 18	do	5.50	10.2	Aug. 21	do	5.55	7.4

[a] Stage-discharge relation seriously affected by backwater from beaver dam on control 600 feet below gage and by ice.

[b] Made from highway bridge 1½ miles below gage.

Daily discharge, in second-feet, of Rock Creek near Hinsdale, Mont., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		3,790	106	154	1,720	79	7
2		3,790	144	144	1,040	61	7
3		3,790	135	106	350	52	7
4		2,500	116	98	350	25	10
5		2,000	116	77	350	19	10
6		1,600	97	77	316	19	10
7		1,300	88	75	294	19	10
8		1,050	79	75	250	19	10
9		1,450	70	74	1,180	19	10
10		2,300	70	74	1,180	40	10
11		3,070	62	91	294	61	10
12		3,790	62	89	118	38	27
13		4,160	54	77	98	14	44
14		3,950	54	77	79	10	228
15		3,600	46	66	70	10	119
16		2,750	26	65	52	10	10
17		2,000	16	63	19	10	10
18		1,050	11	44	372	10	10
19		860	11	25	206	10	10
20	1,130	680	11	25	98	8	10
21	1,750	560	20	31	70	7	10
22	1,490	440	20	206	31	7	10
23	1,240	350	20	696	14	6	10
24	868	280	20	206	10	5	10
25	600	220	315	173	14	5	10
26	1,020	180	1,380	140	10	4	10
27	1,780	160	624	118	10	4	10
28	2,720	130	397	79	10	4	10
29	2,780	110	174	1,350	10	4	10
30	2,850	88	174	2,410	1,300	4	10
31	3,200		174		640	7	

Monthly discharge of Rock Creek near Hinsdale, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 20-31	3,200	600	1,790	42,600
April	4,160	88	1,730	103,000
May	1,380	11	151	9,280
June	2,410	25	233	13,900
July	1,720	10	340	20,900
August	79	4	19.0	1,170
September	228	7	22.3	1,330
The period				192,000

PORCUPINE CREEK AT NASHUA, MONT.

Location.—In NE. ¼ sec. 31, T. 28 N., R. 42 E., 500 feet above ford, one-fourth mile above highway bridge, three-eighths of a mile north of Nashua, in Valley County.

Drainage area.—Not measured.

Records available.—July 11, 1908, to September 30, 1916.

Gage.—Vertical staff in three sections nailed to trees on the left bank. Read by Rosie Brocksmith.

Discharge measurements.—Made by wading near gage, or from bridge one-fourth mile below.

Channel and control.—Bed of the stream is of mud. Slight gravel bar forms the control at low stages, but as the creek rises the bar is soon drowned out and the control becomes indefinite.

Extremes of discharge.—Maximum stage recorded during year, 18.0 feet, April 11; measured by leveling from flood marks (discharge, determined from extension of rating curve 2,700 second-feet); minimum stage recorded, 3.0 feet, August 19 (discharge zero).

1909–1916: Maximum stage recorded April 11, 1916; channel reported dry, August 18 to September 4, 1909; May 27 to June 7, July 12–29, 1910; June 21 to September 5, 1911; August 1–31, 1913; August 19, 1916.

Ice.—Stage-discharge relation seriously affected by ice. Discharge very small. Observations discontinued during winter months.

Diversions.—None during 1916. A United States Reclamation Service canal, which will divert the entire flow during the irrigation season, is practically completed.

Regulation.—None developed. A United States Reclamation Service reservoir on the middle fork of stream will partly regulate flood flow.

Accuracy.—Stage-discharge relation not permanent; affected by shifting control and by ice. Rating curves used as follows: October 1 to December 9, well defined between 1 second-foot and 220 second-feet; March 21 to September 30, well defined below 60 second-feet and fairly well defined between 60 and 1,000 second-feet. Gage read to tenths once daily except December 10 to March 20, when stage-discharge relation was affected by ice. Daily discharge ascertained by applying gage height to rating table. Records good for medium and poor for low stages.

Discharge measurements of Porcupine Creek at Nashua, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 8	14.12	804	May 17	4.02	18.0	July 24	3.84	12.5
28	4.80	53	June 19	3.76	9.1	Aug. 20	3.21	.6

ischarge, in second-feet, of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	0.5	0.5	1.3	....	1,000	42	52	835	88	0.2
	.5	.5	1.3	....	1,040	33	42	488	21	.2
	.5	.5	1.3	....	1,030	33	42	386	17	.2
	.5	.5	1.3	....	1,040	33	42	214	14	.2
	.1	.5	1.3	....	1,020	29	33	88	11	.2
	.1	.5	1.3	....	989	29	33	88	7.9	.2
	.1	.5	1.3	....	905	29	33	52	5.5	.2
	.1	.5	1.3	....	775	29	33	52	2.7	.2
	.1	1.3	1.3	....	815	25	25	52	2.7	.2
	.1	.5	....	....	925	25	25	42	2.7	.6
	.1	.5	....	....	1,150	21	25	42	2.7	2.7
	.1	1.3	....	....	1,070	17	25	33	2.7	2.7
	.1	1.3	....	....	1,020	17	25	25	2.7	2.7
	.5	1.3	....	....	956	17	25	17	1.6	1.6
	.5	1.3	....	....	895	17	21	11	.6	1.6
	.5	1.3	....	....	700	17	21	5.5	.6	1.6
	.5	1.3	....	....	612	17	17	5.5	.2	1.6
	.5	1.3	....	....	540	14	17	646	.2	1.6
	.5	1.3	....	....	470	14	11	165	.0	1.6
	.5	1.3	....	....	402	14	11	165	.2	1.6
	.5	1.3	....	11	306	33	11	102	.2	.6
	.5	1.3	....	214	242	95	17	21	.2	1.6
	.5	1.3	....	214	158	70	144	21	.2	1.6
	.5	1.3	....	186	102	58	158	21	.2	1.6
	.5	1.3	....	52	76	42	88	11	.2	1.6
	.5	1.3	....	186	52	137	42	5.5	.2	1.6
	.5	1.3	....	258	52	102	37	11	.6	1.6
	.5	1.3	....	540	52	95	52	7.9	.6	1.6
	.5	1.3	....	608	52	88	709	7.9	.6	1.6
	.5	1.3	....	567	42	76	1,000	290	.2	1.6
	.5	....	....	628	....	52	....	137	.2	....

ly discharge of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
	0.5	0.1	0.38	23
ber	1.3	.5	1.08	61
ber 1-9	1.3	1.3	1.30	23
21-31	628	11	314	6,850
	1,150	42	616	36,700
	137	14	42.6	2,620
	1,000	11	93.9	5,590
	835	5.5	131	8,060
	88	.0	6.05	372
ber	2.7	.2	1.22	73

LITTLE PORCUPINE CREEK BASIN.

LITTLE PORCUPINE CREEK AT FRAZER, MONT.

ATION.—In SE. ¼ NE. ¼ sec. 28, T. 27 N., R. 44 E., half a mile above intake of reservoir, on Fort Peck Indian Reservation, and about half a mile north of Frazer, in Valley County.

AINAGE AREA.—Not measured.

RDS AVAILABLE.—July 13, 1908, to September 30, 1916. From 1908 to 1910 the records were obtained at a site 1½ miles downstream, and from April 14, 1911, to May 10, 1913, at station one-fourth mile below present site.

Gage.—Vertical staff gage, installed May 10, 1913, on left bank, back of the house of Wm. Ivey, by whom it is read. Gages previously used as follows: July 13, 1908, to September 30, 1910, a staff gage 1¾ miles downstream; April 14, 1911, to May 10, 1913, a staff gage one fourth mile below the present site. Flow at the three sites is practically the same.

Discharge measurements.—Made by wading or from railroad bridge.

Channel and control.—Principal control bar of small rocks and gravel on which moss and weeds grow. At high stages willows growing in the bed of the creek might cause small changes in stage-discharge relation.

Extremes of discharge.—Maximum stage recorded during year, 5.0 feet at 6.30 p. m. April 1 (discharge, from extension of rating curve, about 750 second-feet), no flow October to December and August 16 to September 30.

1909–1916: Maximum stage recorded, 5.0 feet April 1, 1916 (discharge, from extension of rating curve, about 750 second-feet); no flow every year in July, August or September.

Ice.—Stream is usually dry during winter months.

Diversions.—None above station. Entire flow is diverted half a mile below station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during year. Rating curve well defined below 160 second-feet and extended above. Gage read to hundredths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good except those below 160 second-feet which are roughly approximate.

Discharge measurements of Little Porcupine Creek at Frazer, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 10	2.15	146	May 17	0.54	6.8	July 24	0.66	9.6
29	.76	13.1	June 19	.54	7.0	Aug. 20		.0

Daily discharge, in second-feet, of Little Porcupine Creek at Frazer, Mont., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1		725	11	16	225	6.3	16		79	6.8	7.6	5.6	0.0
2		652	11	14	113	5.1	17		63	6.3	7.3	5.3	
3		493	10.7	12	56	3.7	18		49	6.3	6.3	41	
4		430	9.6	11	37	3.4	19		35	6.3	6.3	74	
5		346	9.4	12	47	3.4	20		28	5.8	3.5	68	
6		225	8.8	13	21	3.7	21	37	24	12	6.6	27	
7		137	8.8	12	17	3.5	22	20	21	14	8.3	20	
8		79	7.8	8.3	14	3.4	23	16	20	14	11	13	
9		113	7.6	8.6	12	3.2	24	244	18	16	12	10.2	
10		179	7.3	9.4	11	2.9	25	264	17	22	12	8.3	
11		493	7.0	10.2	9.9	2.9	26	264	15	20	12	7.6	
12		605	6.8	9.1	8.3	2.3	27	304	13	30	14	6.0	
13		493	6.8	5.8	7.8	2.3	28	493	13	30	16	5.8	
14		225	7.3	6.8	6.3	2.2	29	472	12	23	19	7.3	
15		137	6.0	7.8	5.8	1.2	30	515	12	22	79	8.8	
							31	559		20		8.6	

Note.—Creek practically dry from Oct. 1, 1915, to spring break-up and after Aug. 16, 1916.

discharge of Little Porcupine Creek at Frazer, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]				0
[illegible]				0
[illegible]				0
[illegible]	559	16	290	6,330
[illegible]	725	12	192	11,400
[illegible]	30	5.8	12.3	756
[illegible]	79	3.5	12.6	750
[illegible]	225	5.3	29.3	1,800
[illegible]	6.3	.0	3.09	98
[illegible]			.0	0

POPLAR RIVER BASIN.

POPLAR RIVER NEAR POPLAR, MONT.

ATION.—In S. ½ sec. 8, T. 28 N., R. 51 E., at United States Reclamation Service camp, 5 miles north of Poplar, in Sheridan County.

AINAGE AREA.—Not measured.

RDS AVAILABLE.—October 5, 1913, to September 30, 1916, at present site; August 15, 1908, to May 1, 1911, in the S. ½ sec. 5, T. 28 N., R. 51 E., at Obershaw's ranch 5 miles north of Poplar; May 2, 1911, to October 4, 1913, at the United States Reclamation Service Camp, in the NE. ¼ sec. 4, T. 29 N., R. 51 E., 18 miles north of Poplar.

E.—Chain on left bank, opposite United States Reclamation Service camp; read by Frank Krauth and Art Pronovort, employees of the United States Reclamation Service.

CHARGE MEASUREMENTS.—Made by wading or from highway bridge at Poplar.

ANNEL AND CONTROL.—Gravel and clay; shifting slightly.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 14.2 feet at 3 p. m. April 13 (discharge, determined from extension of rating curve about 9,510 second-feet); minimum stage recorded, 3.92 feet September 5 (discharge 11 second-feet.)

1908–1916: Maximum stage recorded, 12.0 feet April 10, 1912, determined by leveling from flood marks (discharge determined from extension of rating curve, about 10,000 second-feet); minimum stage recorded, 2.2 feet, July 29 to August 14, 1910 (discharge, 2.0 second-feet).

E.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

VERSIONS.—Diversions for irrigation are made by the United States Reclamation Service above the station.

ULATION.—None.

RACY.—Stage-discharge relation permanent except during floods and in winter. Rating curve used as follows: October 1 to November 10, well defined; March 23 to September 30, well defined between 20 and 1,800 second-feet, and extended beyond these limits. Gage read to quarter-tenths twice daily; oftener during flood stages. Discharge ascertained by applying mean daily gage height to rating table. Records of discharge between 20 and 3,000 second-feet good; others roughly approximate.

*Discharge measurements of Poplar River near Poplar, Mont., during the year endin
Sept. 30, 1916.*

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft*
Apr. 7	7.55	1,600	May 16	5.11	218	July 22	4.34	46.
27	6.19	611	June 18	4.75	115	Aug. 18	4.18	25.

*Daily discharge, in second-feet, of Poplar River near Poplar, Mont., for the year endin
Sept 30, 1916.*

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	47	48	....	7,170	505	256	324	62	
2	48	48	....	7,430	484	223	324	50	
3	69	48	....	7,040	441	207	306	47	
4	195	48	....	6,130	441	192	289	39	
5	138	47	....	4,340	400	178	272	36	
6	125	47	....	2,350	400	178	239	36	
7	113	47	....	1,620	385	175	192	36	
8	125	46	....	1,280	370	157	150	30	
9	113	44	....	1,280	356	150	134	30	
10	113	41	....	2,350	342	145	118	30	
11	99	....	....	5,610	306	134	106	30	
12	85	....	....	8,470	289	123	102	36	
13	81	....	....	9,250	272	123	86	36	
14	78	....	....	8,600	272	118	83	30	
15	75	....	....	7,040	256	118	83	30	
16	72	....	....	6,000	223	112	68	30	
17	69	....	....	4,340	192	112	65	30	
18	69	....	....	2,550	170	116	62	27	
19	67	....	....	1,790	165	98	50	24	
20	65	....	....	1,530	150	79	50	22	
21	63	....	....	1,280	148	86	50	22	
22	61	....	....	1,130	145	123	43	22	
23	61	....	....	925	157	178	36	22	
24	58	....	....	865	170	192	34	22	
25	56	....	....	750	192	170	30	22	
26	53	....	....	695	223	170	30	22	
27	52	....	....	645	239	175	30	22	
28	52	....	7,040	550	256	207	34	18	
29	52	....	7,690	528	324	223	47	18	
30	50	....	6,520	505	306	272	62	18	
31	49	....	6,390	....	289	....	65	18	......

Monthly discharge of Poplar River near Poplar, Mont., for the year ending Sept. 30, 191

Month.	Discharge in second-feet.			Run-off (total in acre-feet)
	Maximum.	Minimum.	Mean.	
October	195	47	79.1	4,8
November 1-10	48	41	46.4	9
March 28-31	7,690	6,390	6,910	54,8
April	9,250	505	3,470	206,0
May	505	145	286	17,6
June	272	79	160	9,5
July	324	30	115	7,0
August	62	18	29.6	1,8
September	50	11	24.2	1,4

BIG MUDDY CREEK BASIN.

BIG MUDDY CREEK NEAR CULBERTSON, MONT.

LOCATION.—In NE. ¼ sec. 20, T. 29 N., R. 54 E., at Kraft's (formerly Sholtz's) ranch, 11 miles above mouth of stream, 15 miles northwest of Culbertson, in Sheridan County, and 8 miles above site of original station at Boyd's ranch, which was discontinued because of backwater from Missouri River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 19, 1909, to September 30, 1916, at present station; July 14, 1908, to July 19, 1909, at original station.

GAGE.—An inclined staff on the left bank near the house on Kraft's ranch; read by Thomas Shields until August 19, 1916; then by Jacob Kraft. This gage has been used since July 19, 1909; before that date a staff gage at Boyd's ranch, 8 miles downstream, was used.

DISCHARGE MEASUREMENTS.—Made by wading or from the bridge about 9 miles below the gage.

CHANNEL AND CONTROL.—Creek has small crooked channel, and mud banks, which are fairly high and seldom overflowed. Extreme low-water control consists of bar of gravel with a few small boulders; but as the stage increases the bar is drowned out and the control becomes indefinite. Weeds grow thick in the channel above the control during the summer months and cause backwater at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.4 feet at 3 p. m. March 31 (discharge, 1,550 second-feet); minimum stage, 2.1 feet October 10, November 2 and 5 (discharge, 1 second-foot).

1909–1916: Maximum stage recorded, 11.4 feet March 31, 1916 (discharge, 1,550 second-feet); minimum stage, 1.5 feet September 16–18, 1915 (discharge 0).

ICE.—Little if any flow during January, February, October, November and December.

DIVERSIONS.—Several small pumping plants divert water for irrigation above station; amount unknown.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; seriously affected by ice and by backwater from aquatic growth in channel during the last part of summer. Rating curves used as follows: October 1 to November 5, fairly well defined between 7 and 120 second-feet; March 26 to August 4, well defined between 80 and 1,400 second-feet; August 19 to September 30, well defined below 30 second-feet; August 5–18, interpolated. Gage read to tenths about every other day until August 4; to hundredths once daily after August 19. Discharge ascertained by applying gage height to rating table. Records good October to July; fair August and September.

Discharge measurements of Big Muddy Creek near Culbertson, Mont., during the year ending Sept. 30, 1916.

[Made by A. H. Tuttle.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
[illegible]	10.73	1,360	May 15 a	4.72	204	July 20 a	3.56	98
[illegible]	7.42	636	June 17 a	3.30	84	Aug. 19 b	2.85	18

a Measured at highway bridge 8 miles below gage.

b Measurements made by wading at ford 300 feet below gage. Stage-discharge relation seriously affected by backwater caused by aquatic plants in channel.

Daily discharge, in second-feet, of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2	a 1	....	1,430	378	142	362	a 46	6.2
2	a 2	1	....	1,430	a 347	a 140	a 351	33	5.5
3	2	a 1	....	a 1,430	316	a 137	a 340	a 31	4.8
4	a 2	a 1	....	a 1,430	a 277	134	330	29	5.5
5	3	1	....	1,430	238	a 122	a 284	28	5.5
6	a 3	....	....	1,430	a 232	110	238	27	5.5
7	3	....	....	1,390	226	a 100	a 190	26	5.5
8	3	....	....	a 1,380	a 214	89	142	25	4.8
9	3	....	....	1,360	202	a 75	a 134	24	4.0
10	1	....	....	a 1,360	a 186	61	126	24	5.5
11	2	....	....	1,360	170	a 61	a 118	23	7.0
12	2	....	....	a 1,360	a 170	61	110	22	6.2
13	a 2	....	....	1,360	170	a 55	a 103	21	5.5
14	2	....	....	1,410	a 186	50	96	20	6.2
15	3	....	....	a 1,400	202	a 60	a 89	20	7.0
16	a 3	....	....	1,390	a 188	a 71	82	19	9.0
17	a 5	....	....	1,390	a 174	82	a 72	19	11.0
18	5	....	....	a 1,390	160	a 82	61	18	13.0
19	a 5	....	....	1,390	150	82	a 80	18	12.0
20	5	....	....	a 1,360	a 150	a 104	100	20	11.0
21	5	....	....	1,340	a 150	126	a 115	16	10.0
22	a 4	....	....	a 1,240	150	a 134	130	13	9.0
23	3	....	....	1,150	a 150	142	a 122	12	9.0
24	a 3	....	....	1,060	150	a 151	114	10	7.0
25	3	....	....	a 847	a 150	a 160	a 107	9	7.0
26	a 3	....	970	634	150	170	100	8	6.2
27	a 3	....	1,220	a 594	a 150	214	a 84	7	7.0
28	a 3	....	a 1,260	554	150	a 265	68	6.2	6.2
29	3	....	1,310	496	a 146	316	a 64	5.5	6.2
30	2	....	1,410	460	142	346	a 61	5.5	5.5
31	2	....	1,550	....	a 142	....	58	6.2	....

a Discharge interpolated.

Monthly discharge of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	5	1	2.97	183
November 1-5	1	1	1.00	9.9
March 26-31	1,550	970	1,290	15,400
April	1,430	460	1,210	72,000
May	378	142	192	11,800
June	346	50	128	7,620
July	362	58	143	8,790
August	46	5.5	19.1	1,170
September	13	4.0	7.13	424

YELLOWSTONE RIVER BASIN.

YELLOWSTONE RIVER NEAR CANYON HOTEL,[1] YELLOWSTONE NATIONAL PARK.

Location.—Approximately in secs. 9-16, T. 13 S., R. 10 E., Montana meridian, 30 feet east of stage road from Lake Yellowstone to Yellowstone Canyon, half a mile upstream from Upper Falls and Canyon soldier station, 1½ miles south of Canyon Hotel, and about 13 miles below outlet of Lake Yellowstone.

Drainage area.—Not measured.

Records available.—June 22, 1913, to September 30, 1916.

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[1] Formerly known as Yellowstone River at Canyon soldier station.

Gage.—Vertical staff on left bank, one-eighth mile above Chittenden Bridge, read by privates or noncommissioned officers attached to the Canyon soldier station. Present gage used since September 13, 1913. Original gage, used June 22 to September 12, 1913, was of same type and at same site but set to a datum 1.03 feet higher than that of present gage; readings on original gage reduced to datum of present gage.

Discharge measurements.—Made by wading at low stages at a gravel and boulder section 100 feet below the gage. High-stage measurements made from Fishing bridge, about 13 miles upstream, and the measured inflow of tributary streams between this point and the gage added.

Channel and control.—One channel at all stages. Bed of stream gravel and boulders. Rock control at head of rapids about 600 feet below gage; practically permanent. Water opposite and above gage, deep and sluggish. Aquatic growth affects stage-discharge relation during summer months.

Ice.—Stage-discharge relation affected by ice; gage readings discontinued during winter.

Extremes of discharge.—Maximum stage recorded during year 5.0 feet July 4–10 (discharge July 4–6, 6,470 second-feet); minimum stage recorded, 0.75 foot at 3.30 p. m. October 16 (discharge, 675 second-feet). Gage height and discharge lower during winter period.

1913–1916: Maximum stage recorded, 5.35 feet June 23 and 25, 1913 (discharge, 7,060 second-feet); minimum stage, 0.75 foot October 16, 1915 (discharge, 675 second-feet). Gage height and discharge lower during winter periods.

Diversions.—None above station.

Regulation.—None.

Accuracy.—Control believed to have remained permanent, but stage-discharge relation is affected by aquatic growth each summer, usually from July to September. Rating curve is fairly well defined, partly by measurements made from a cable during 1917. Gage read once daily to half tenths except during winter months. Discharge ascertained by applying daily gage height to rating table or by shifting-control method. Records fair.

The following discharge measurement was made by Baldwin and Hoyt: July 13, 1916: Gage height, 4.07 feet; discharge, 4,660 second-feet, no allowance being made for inflow between Fishing bridge and station.

Daily discharge, in second-feet, of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the years ending Sept. 30, 1913–1916.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1913.					1913.				
1	....	6,810	5,790	2,670	16	....	6,130	3,790	1,860
2	....	6,720	5,880	2,670	17	....	5,960	3,710	1,760
3	....	6,720	5,960	2,600	18	....	5,700	3,630	1,670
4	....	6,720	5,960	2,530	19	....	5,540	3,630	1,580
5	....	6,560	5,790	2,460	20	....	5,540	3,560	1,490
6	....	6,560	5,450	2,390	21	6,900	5,450	3,480	1,500
7	....	6,560	5,020	2,390	22	6,900	5,200	3,400	1,560
8	....	6,560	4,760	2,340	23	7,060	5,280	3,260	1,570
9	....	6,380	4,590	2,290	24	6,980	5,020	3,180	1,570
10	....	6,380	4,330	2,230	25	7,060	5,110	3,100	1,630
11	....	6,380	4,320	2,180	26	6,980	5,200	3,030	1,630
12	....	6,380	4,060	2,130	27	6,900	5,360	2,880	1,640
13	....	6,380	3,960	2,130	28	6,900	5,200	2,810	1,640
14	....	6,300	3,950	2,040	29	6,900	5,200	2,740	1,650
15	....	6,220	3,950	1,950	30	6,810	5,960	2,740	1,650
					31	....	5,790	2,740	....

Daily discharge, in second-feet, of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the years ending Sept. 30, 1913–1916—Continued.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.									
1	1,610	1,200	....	....	....	3,060	4,300	2,850	1,290
2	1,610	1,200	....	....	....	3,210	4,600	2,710	1,280
3	1,610	1,200	....	....	....	3,510	4,280	2,710	1,260
4	1,560	1,200	....	....	....	3,820	4,270	2,710	1,240
5	1,500	1,200	....	....	....	4,140	4,410	2,710	1,220
6	1,500	1,200	....	....	....	4,300	4,570	2,570	1,210
7	1,500	1,160	669	....	....	4,300	4,400	2,570	1,190
8	1,500	1,160	....	....	....	4,300	4,380	2,430	1,170
9	1,560	1,160	....	....	1,350	4,300	4,540	2,430	1,160
10	1,560	1,110	....	....	1,250	4,300	4,360	2,300	1,140
11	1,500	1,110	....	....	....	4,300	4,350	2,300	1,120
12	1,500	1,060	....	....	....	4,300	4,330	2,300	1,100
13	1,450	1,020	....	....	....	4,140	4,170	2,170	1,090
14	1,400	978	....	....	....	4,140	4,160	2,170	1,070
15	1,400	935	....	....	....	4,140	4,160	2,170	1,070
16	1,400	935	....	....	1,350	4,300	3,980	2,170	1,070
17	1,400	895	....	....	1,350	4,140	3,960	2,040	1,080
18	1,350	855	....	....	1,500	4,140	3,800	1,910	1,050
19	1,350	....	....	....	1,610	4,140	3,790	1,790	1,060
20	1,350	....	....	....	1,610	4,140	3,620	1,790	1,160
21	1,350	....	....	....	1,720	4,620	3,620	1,790	1,260
22	1,300	....	....	....	1,840	4,940	3,600	1,620	1,270
23	1,300	....	....	....	1,960	4,940	3,450	1,510	1,280
24	1,300	....	....	....	2,090	4,940	3,450	1,460	1,290
25	1,300	....	....	....	2,220	4,940	3,300	1,460	1,300
26	1,300	....	....	....	2,350	4,940	3,300	1,410	1,260
27	1,250	....	....	....	2,350	4,780	3,150	1,410	1,270
28	1,250	....	....	....	2,490	4,620	3,000	1,360	1,230
29	1,250	....	....	....	2,630	4,460	3,000	1,360	1,240
30	1,200	....	....	....	2,770	4,300	2,850	1,310	1,250
31	1,200	....	....	....	2,910	....	2,850	1,310	....
1914–15.									
1	1,250	1,160	....	....	....	1,350	1,610	2,740	1,480
2	1,300	1,160	....	....	....	1,350	1,650	2,740	1,480
3	1,400	1,160	....	....	....	1,350	1,650	2,740	1,480
4	1,300	1,160	....	....	....	1,300	1,700	2,600	1,480
5	1,300	1,160	....	....	....	1,300	1,760	2,600	1,430
6	1,300	1,160	....	....	....	1,400	1,740	2,600	1,430
7	1,300	1,160	....	....	....	1,450	1,800	2,460	1,430
8	1,250	1,160	....	....	....	1,500	1,910	2,320	1,430
9	1,250	1,160	....	....	....	1,720	1,910	2,320	1,430
10	1,250	1,160	....	....	....	1,960	2,020	2,190	1,430
11	1,300	1,160	....	....	....	1,960	2,160	2,190	1,430
12	1,300	1,160	....	....	....	2,090	2,270	2,060	1,380
13	1,300	1,160	....	....	....	1,840	2,270	2,060	1,330
14	1,300	1,160	....	....	1,250	1,780	2,390	1,940	1,330
15	1,250	1,160	....	....	1,300	1,780	2,390	1,940	1,140
16	1,250	1,160	....	....	1,250	1,780	2,520	1,940	1,140
17	1,250	1,110	....	....	1,300	1,720	2,520	1,820	1,140
18	1,250	....	....	....	1,300	1,720	2,500	1,820	1,140
19	1,250	....	....	....	1,300	1,720	2,640	1,820	1,100
20	1,250	....	....	....	1,300	1,720	2,630	1,820	1,110
21	1,250	....	....	....	1,300	1,660	2,770	1,820	1,120
22	1,250	....	....	....	1,200	1,660	2,760	1,700	1,130
23	1,250	....	....	....	1,350	1,660	2,760	1,700	1,140
24	1,250	....	....	....	1,350	1,500	2,880	1,640	1,150
25	1,250	....	....	....	1,400	1,500	2,880	1,590	1,150
26	1,250	....	....	....	1,400	1,500	2,880	1,590	1,110
27	1,250	....	....	....	1,400	1,560	2,740	1,480	1,120
28	1,250	....	....	....	1,450	1,560	2,740	1,480	1,130
29	1,250	....	....	....	1,450	1,560	2,740	1,480	1,140
30	1,200	....	....	....	1,450	1,610	2,740	1,480	1,150
31	1,200	....	....	....	1,400	....	2,740	1,480	....

Daily discharge, in second feet, of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the years ending Sept. 30, 1913–1916—Continued.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	1,110					2,490	6,130	4,560	2,300
2	1,060					2,490	6,130	4,560	2,170
3	1,020					2,490	6,300	4,560	2,170
4	978					2,630	6,470	4,400	2,170
5	978					2,630	6,470	4,400	2,040
6	935					2,630	6,470	4,240	1,910
7	935					2,630	6,450	4,240	1,910
8	895					2,630	6,450	4,240	1,790
9	855					2,630	6,440	4,240	1,680
10	855					2,770	6,440	4,080	1,680
11	780					2,910	6,250	3,920	1,620
12	780					2,910	6,060	3,920	1,620
13	745					3,060	6,060	3,920	1,570
14	745					3,210	6,040	3,920	1,570
15	710					3,360	5,880	3,920	1,570
16	675					3,510	5,690	3,920	1,580
17					935	3,660	5,670	3,760	1,530
18					1,020	3,660	5,670	3,600	1,490
19					1,110	3,660	5,480	3,600	1,450
20					1,200	3,820	5,300	3,600	1,410
21					1,300	3,820	5,300	3,450	1,420
22					1,400	3,980	5,280	3,450	1,380
23					1,400	4,140	5,110	3,300	1,390
24					1,610	4,140	4,920	3,300	1,400
25					1,720	4,460	4,910	3,300	1,360
26					1,720	4,780	4,910	3,150	1,370
27					1,840	5,110	4,730	3,000	1,330
28					1,960	5,450	4,570	2,850	1,340
29					2,090	5,620	4,560	2,710	1,300
30					2,220	5,790	4,560	2,570	1,300
31					2,350		4,720	2,430	

Monthly discharge of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the years ending Sept. 30, 1913–1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1913.				
June 21–30	7,060	6,810	6,940	138,000
July	6,810	5,020	5,980	368,000
August	5,960	2,740	4,050	249,000
September	2,670	1,490	1,980	118,000
1913–14.				
October	1,610	1,200	1,410	86,700
November 1–18	1,200	855	1,090	38,900
May 9–31	2,910		1,800	82,100
June	4,940	3,060	4,290	255,000
July	4,600	2,850	3,870	238,000
August	2,850	1,310	2,030	125,000
September	1,800	1,050	1,190	70,800
1914–15.				
October	1,400	1,200	1,270	78,100
November 1–17	1,160	1,110	1,160	39,100
May 14–31	1,450	1,200	1,340	47,800
June	2,090	1,300	1,620	96,400
July	2,880	1,610	2,340	144,000
August	2,740	1,480	2,010	124,000
September	1,480	1,100	1,270	75,600
1915–16.				
October 1–16	1,110	675	878	27,900
May 17–31	2,350	935	1,590	47,300
June	5,790	2,490	3,570	212,000
July	6,470	4,560	5,660	348,000
August	4,560	2,430	3,710	228,000
September	2,300	1,300	1,630	97,000

YELLOWSTONE RIVER AT CORWIN SPRINGS, MONT.

Location.—In NE. ¼ sec. 30, T. 8 S., R. 8 E., at highway bridge in canyon at Corwin Springs, in Park County, 8 miles below Gardiner, northern entrance to Yellowstone National Park.

Drainage area.—2,630 square miles.

Records available.—September 2, 1910, to September 30, 1916.

Gage.—Chain gage fastened to floor of highway bridge on downstream side near right bank. Before October 25, 1911, staff gage set to same datum and fastened to pile beside concrete abutment on right bank. Gage read by Mrs. C. H. Wilks.

Discharge measurements.—Made from downstream side of highway bridge.

Channel and control.—Bed of stream composed of small rocks. Current swift at all stages. No definite control visible but has not shifted since station was established. Banks high; not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 9.8 feet June 18 and 19 (discharge, 20,900 second-feet); minimum stage recorded, 0.6 foot January 1 (discharge, 830 second-feet).

1910–1916: Maximum stage recorded, 10.2 feet June 13, 1911 (discharge, 22,800 second-feet); minimum stage recorded, 0.6 foot January 1, 1916 (discharge, 830 second-feet). Estimates of daily flow were made for the winter of 1911–12 only. The estimated mean monthly flow for January and February, 1911, was 900 second-feet.

Ice.—Stage-discharge relation not seriously affected by ice except in extremely cold weather, largely because of high velocity of water.

Diversions.—No water diverted from the Yellowstone above station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent since station was established. Rating curve well defined between 1,010 and 18,300 second-feet. Gage read to half tenths once daily. Discharge ascertained by applying daily gage heights to rating table. Records excellent.

The following discharge measurement was made by W. A. Lamb: August 4, 1916: Gage height, 4.70 feet; discharge, 5,970 second-feet.

Daily discharge, in second-feet, of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,010	1,310	1,010	830	....	960	1,310	2,560	5,800	18,300	6,730	3,060
2	1,900	1,310	1,900	910	....	1,010	1,310	2,340	5,180	17,700	6,250	3,060
3	1,900	1,310	1,700	1,070	....	1,010	1,310	2,340	4,980	18,600	6,020	3,060
4	1,900	1,310	1,800	910	....	1,140	1,220	2,800	5,800	16,400	6,020	3,060
5	1,800	1,310	1,900	910	....	1,070	1,220	4,240	8,760	14,600	5,800	2,800
6	1,700	1,220	1,140	910	....	1,140	1,140	4,600	7,220	15,500	5,800	2,930
7	1,700	1,220	1,140	910	....	1,010	1,220	7,470	6,970	15,800	5,800	2,800
8	1,700	1,220	1,140	910	....	1,140	1,310	5,380	7,720	15,200	5,380	2,680
9	1,600	1,310	1,140	910	....	1,140	1,310	6,490	9,030	15,500	5,280	2,680
10	1,600	1,220	1,070	910	910	1,140	1,310	5,380	11,300	14,900	5,180	2,560
11	1,500	1,140	1,010	910	910	1,220	1,400	4,420	9,870	13,400	5,180	2,560
12	1,500	1,220	1,070	....	910	1,220	1,500	3,610	9,030	12,200	4,980	2,560
13	1,600	1,140	1,140	....	910	1,310	1,310	3,610	9,590	12,800	4,980	2,560
14	1,600	1,220	1,070	....	960	1,140	1,400	3,330	11,000	12,200	4,790	2,340
15	1,500	1,220	1,010	....	1,010	1,220	1,700	3,060	13,700	11,600	4,600	2,340
16	1,500	1,310	1,010	....	1,010	1,220	1,500	2,930	15,800	11,000	4,420	2,340
17	1,600	1,220	960	....	1,010	1,310	1,600	3,060	18,600	10,400	4,240	2,230
18	1,500	1,220	910	....	1,010	1,310	1,700	2,930	20,900	10,100	4,240	2,120
19	1,500	1,220	1,010	....	1,010	1,310	1,600	3,330	20,900	9,870	4,070	2,120
20	1,500	1,140	1,140	....	1,010	1,500	1,500	4,420	18,000	9,310	3,900	2,230
21	1,500	1,220	1,140	....	1,070	1,500	1,500	4,980	16,100	9,310	3,900	2,230
22	1,500	1,140	1,070	....	1,010	1,400	1,500	4,790	14,000	8,760	3,750	2,120
23	1,500	1,140	1,140	....	1,070	1,500	1,500	4,420	12,500	8,490	3,610	2,120
24	1,700	1,140	960	....	1,070	1,310	1,600	3,900	12,200	7,720	3,470	2,230
25	2,340	960	910	....	1,140	1,310	1,900	3,900	12,500	7,220	3,330	2,120
26	1,500	1,010	910	....	1,140	1,310	2,450	3,900	14,000	7,220	3,190	2,120
27	1,500	910	910	....	1,010	1,220	3,190	3,610	15,800	6,970	3,060	2,120
28	1,500	1,010	910	....	1,010	1,310	4,240	3,750	19,300	7,720	3,190	2,120
29	1,500	1,140	870	....	960	1,310	3,610	4,600	20,200	7,220	3,060	2,010
30	1,310	1,010	910	....	....	1,220	2,800	5,380	19,300	7,220	3,060	2,010
31	1,310	....	870	....	....	1,310	....	6,490	....	6,970	3,060	....

Note.—Discharge Jan. 12–31 and Feb. 1–9 estimated at 910 second-feet.

Monthly discharge of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,340	1,310	1,620	99,600
November	1,310	910	1,180	70,200
December	1,900	870	1,120	68,900
January	1,070	830	913	56,100
February	1,140	....	977	56,200
March	1,500	960	1,230	75,600
April	4,240	1,140	1,740	104,000
May	7,470	2,340	4,130	254,000
June	20,900	4,980	12,500	744,000
July	18,600	6,970	11,600	713,000
August	6,730	3,060	4,530	279,000
September	3,060	2,010	2,440	145,000
The year	20,900	....	3,680	2,670,000

YELLOWSTONE RIVER AT HUNTLEY, MONT.

LOCATION.—In SW. ¼ sec. 24, T. 2 N., R. 27 E., at new steel highway bridge 1 mile below Huntley, in Yellowstone County, 1 mile below mouth of Pryor Creek.

DRAINAGE AREA.—12,000 square miles.

RECORDS AVAILABLE.—October 1, 1907, to November 12, 1916, when station was discontinued. For station at Junction, where discharge is practically the same as at Huntley, May 10, 1906, to December 31, 1907.

GAGE.—Chain fastened to bridge rail on downstream side; read by E. V. Carpenter, employee of the United States Reclamation Service.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed of channel composed of gravel; current very swift at all stages causing frequent shifts in stream bed. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.5 feet June 30 (discharge, 58,100 second-feet); minimum stage recorded, 3.6 feet March 26 (discharge, 3,100 second-feet).

1906–1916: Maximum stage recorded, 12.5 feet June 30, 1916, (discharge, 58,100 second-feet); minimum stage recorded, 1.1 feet December 26-28, 1907 (discharge, 1,060 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; data insufficient to warrant estimates of flow.

DIVERSIONS.—The Huntley canal, built by the United States Reclamation Service and supplying water for 29,000 acres, takes water from river about 2 miles above gaging station; normal capacity of canal 400 second-feet. Near Laurel are the headgates of the Billings Land & Irrigation Co.'s canal, which carries about 305 second-feet and irrigates 28,000 acres. Many small ditches take water from the tributaries of the Yellowstone but few from the river itself, owing to variation of stage and consequent difficulty of diversion.

REGULATION.—Yellowstone Lake furnishes some natural regulation.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and seriously affected by ice in winter. Rating curves used as follows: October 1 to November 4, 1915, fairly well defined; March 1 to June 20 and July 1 to November 12, 1916, poorly defined. Gage read to quarter tenths once daily. Discharge ascertained by applying gage height to rating table; shifting-control method used June 21–30. Records only fair.

Discharge measurements of Yellowstone River at Huntley, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 23	3.80	3,640
Aug. 5	5.45	12,000

Daily discharge, in second-feet, of Yellowstone River at Huntley, Mont., for the period Oct. 1, 1915, to Nov. 12, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	5,030	3,760	13,600	3,370	5,090	10,700	55,000	13,900	5,860
2	5,030	3,520	13,600	3,500	4,200	10,700	54,300	13,400	5,530
3	5,030	3,520	13,600	3,920	4,790	10,300	52,900	12,400	5,530
4	5,030	3,520	13,100	3,640	5,390	11,200	48,000	11,900	5,530
5	5,030	....	13,600	3,500	5,390	12,100	43,800	11,900	5,530
6	4,770	....	13,100	3,370	6,370	14,800	41,700	11,900	5,530
7	4,510	....	13,100	3,370	9,820	17,000	41,700	11,900	5,530
8	4,510	....	12,600	3,370	15,800	18,000	42,400	11,400	5,530
9	4,510	....	12,600	3,370	14,200	19,700	44,800	10,900	5,530
10	4,510	....	12,100	3,500	13,100	20,900	46,600	10,900	5,530
11	4,510	....	12,100	3,640	11,200	22,100	42,400	10,000	5,860
12	4,510	....	11,200	3,500	10,300	24,000	39,600	9,580	6,200
13	4,510	....	10,300	3,640	11,200	22,700	38,300	8,780	6,540
14	4,510	....	9,820	3,640	9,390	21,500	36,200	8,380	6,200
15	4,510	....	8,970	3,920	8,970	26,600	34,900	8,000	6,200
16	4,510	....	8,970	4,200	8,970	33,600	33,500	8,000	6,200
17	4,510	....	7,080	4,200	8,570	37,800	32,200	7,620	5,860
18	4,510	....	6,030	4,200	8,180	44,800	30,200	7,620	5,860
19	4,510	....	5,390	3,920	8,570	53,900	27,600	7,620	5,530
20	4,260	....	4,790	3,920	9,390	56,000	25,600	7,250	5,530
21	4,010	....	4,200	3,640	12,100	54,300	25,000	6,890	5,530
22	4,010	....	3,500	3,640	14,200	49,100	23,000	6,890	5,530
23	4,010	....	3,500	3,640	13,100	42,600	20,000	6,890	5,210
24	4,010	....	3,240	3,640	11,600	34,900	18,900	6,540	5,210
25	4,010	....	3,100	3,920	11,600	36,400	17,700	6,540	5,210
26	4,010	....	3,100	4,200	11,200	37,500	16,600	6,200	5,210
27	3,760	....	3,240	5,090	10,700	43,500	15,000	5,860	5,210
28	3,760	....	3,370	6,370	10,700	50,300	15,000	5,860	4,910
29	3,760	....	3,240	7,080	10,700	56,300	16,600	5,860	4,910
30	4,010	....	3,370	6,370	10,700	58,100	15,000	5,860	4,910
31	3,760	....	3,370	....	10,700	....	14,500	5,860	....

Day.	Oct.	Nov.	Day.	Oct.	Nov.	Day.	Oct.	Nov.
1916.			1916.			1916.		
1	4,910	5,210	11	5,210	4,620	21	5,530	....
2	4,910	5,210	12	5,210	4,620	22	5,530	....
3	4,910	4,910	13	5,210	....	23	5,530	....
4	4,910	5,210	14	5,210	....	24	5,530	....
5	4,910	4,910	15	5,530	....	25	5,530	....
6	4,910	4,910	16	5,530	....	26	5,530	....
7	4,910	4,910	17	5,530	....	27	5,530	....
8	4,910	4,910	18	5,530	....	28	5,530	....
9	4,910	4,910	19	5,210	....	29	5,530	....
10	4,910	4,620	20	5,210	....	30	5,210	....
						31	5,210	....

Monthly discharge of Yellowstone River at Huntley, Mont., for the period Oct. 1, 1915, to Nov. 12, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	5,030	3,760	4,380	269,000
November 1–4	3,760	3,520	3,580	28,400
March	13,600	3,100	8,160	502,000
April	7,060	3,370	4,040	240,000
May	15,800	4,200	9,880	608,000
June	58,100	10,300	31,700	1,890,000
July	55,000	14,500	32,500	2,000,000
August	13,900	5,860	8,790	540,000
September	6,540	4,910	5,580	332,000
1916.				
October	5,530	4,910	5,250	323,000
November 1–12	5,210	4,620	4,910	117,000

YELLOWSTONE RIVER AT INTAKE, MONT.

Location.—In NW. ¼ sec. 36, T. 18 N., R. 56 E., at Lower Yellowstone diversion dam at Intake, in Dawson County, 18 miles below Glendive.

Drainage area.—Not measured.

Records available.—January 1, 1911, to September 30, 1916; at Glendive, 18 miles above, by War Department and Department of Agriculture 1893 to 1903, and by Geological Survey August 1, 1903, to December 31, 1910.

Gage.—Chain gage on north abutment of dam showing depth of water on crest; read by Howard Roby and Matt Griebler, employees of the United States Reclamation Service.

Discharge measurements.—Made from bridge at Glendive.

Channel and control.—Dam forming principal control is a rock filled timber-crib structure on pile foundation, completed January 29, 1910; 700 feet long; crosses the stream at right angles to current, and raises low water level about 4 feet; specially designed to resist the destructive effects of ice by approach on a slope of 3 to 1; downstream face is ogee-shaped and protected by a heavy rock apron.

Extremes of discharge.—Maximum stage recorded during year, 10.3 feet at 2.30 p. m. February 20 (stage-discharge relation affected by ice; discharge not computed); minimum stage recorded, 1.6 feet November 30 and December 1 and 2, 18 and 19 (discharge, 5,760 second-feet).

1903–1915: Maximum stage recorded, 10.1 feet July 4, 1912 (discharge, 112,000 second-feet); minimum stage recorded, 0.9 foot December 26–28, 1912 (discharge, 2,950 second-feet).

Ice.—Stage-discharge relation seriously affected by ice January 1 to March 10.

Diversions.—The Lower Yellowstone canal, which diverts water to irrigate 66,000 acres of land, heads at the north abutment of dam. There are also many diversions on the tributaries above the station.

Regulation.—Yellowstone Lake and Shoshone reservoir form the only important regulation above, and control only a small part of the flood flow.

Accuracy.—Stage-discharge relation permanent except January 1 to March 10, when ice froze to crest of dam. Rating curve fairly well defined by discharge measurements made at Glendive and curve of relation between gage heights at Glendive and at Lower Yellowstone dam. Gage reads to tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Results good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	23,400	7,260	5,760	....	8,940	14,400	18,600	83,000	23,400	7,800
2	19,500	7,260	5,760	....	8,360	14,400	21,400	81,500	25,400	7,260
3	17,700	7,260	6,240	....	8,360	12,900	23,400	78,400	23,400	6,740
4	16,800	7,260	6,240	....	7,800	12,900	23,400	69,100	20,400	6,740
5	14,400	7,260	6,740	....	8,360	12,200	23,400	72,200	29,600	6,740
6	13,600	7,260	6,740	....	8,360	12,200	23,400	72,200	22,400	6,740
7	13,600	7,260	6,740	....	8,940	12,200	23,400	61,400	23,400	6,240
8	13,600	7,800	6,740	....	8,940	12,200	27,500	64,400	21,400	6,740
9	12,200	7,260	6,740	....	8,940	12,900	30,800	58,200	21,400	6,740
10	11,500	6,740	6,240	....	8,940	13,600	28,600	59,800	19,500	6,740
11	11,500	6,740	6,240	94,200	8,940	17,700	27,500	58,200	17,700	6,740
12	10,800	6,740	6,740	94,200	8,360	23,400	32,000	56,800	16,000	7,800
13	10,200	6,740	6,740	58,200	8,360	23,400	39,400	50,800	15,200	8,940
14	10,200	6,740	6,740	42,200	8,360	23,400	39,400	45,000	14,400	7,800
15	10,200	6,740	6,240	30,800	8,360	20,400	36,800	42,200	14,400	7,800
16	10,200	6,740	6,240	20,400	8,360	19,500	42,200	75,300	13,600	6,740
17	10,200	6,740	6,240	16,800	8,360	18,600	42,200	45,000	12,900	6,740
18	10,200	6,740	5,760	14,400	8,940	18,600	45,000	42,200	12,200	6,740
19	10,200	6,240	5,760	14,400	8,940	17,700	55,200	35,600	11,500	6,740
20	9,540	6,240	6,240	12,900	8,940	15,200	67,600	34,300	10,800	6,740
21	9,540	6,240	6,240	12,900	9,540.	15,200	78,400	33,100	10,200	6,240
22	9,540	6,240	6,240	11,500	9,540	15,200	84,600	29,600	10,200	6,240
23	8,940	6,240	6,740	10,800	9,540	16,000	101,000	27,500	9,540	6,240
24	8,940	6,240	6,740	10,200	9,540	19,500	84,600	25,400	9,540	6,240
25	8,940	6,240	6,740	10,800	8,940	23,400	69,100	25,400	9,540	6,240
26	8,940	6,240	6,740	10,800	9,540	24,400	59,800	23,400	8,940	6,240
27	8,940	6,240	6,740	9,540	10,200	21,400	50,800	22,400	8,940	6,240
28	8,360	6,240	7,260	8,940	12,900	21,400	59,800	23,400	8,360	6,240
29	7,800	6,740	7,260	8,360	12,900	19,500	53,800	24,400	7,800	6,240
30	7,260	5,760	6,740	8,360	14,400	18,600	78,400	21,400	7,800	6,240
31	7,260	....	6,240	8,940	....	17,700	....	25,400	7,800	....

NOTE.—No determination of discharge, Jan. 1 to Mar. 10, owing to uncertainty concerning the extent to which stage-discharge relation was affected by ice.

Monthly discharge of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	23,400	7,260	11,400	701,000
November	7,800	5,760	6,710	339,000
December	7,260	5,760	6,470	398,000
March 11–31	94,200	8,360	24,300	1,010,000
April	14,400	7,800	9,300	553,000
May	24,400	12,200	17,400	1,070,000
June	101,000	18,600	46,400	2,760,000
July	83,000	21,400	47,300	2,910,000
August	29,600	7,800	15,100	928,000
September	8,940	6,240	6,790	404,000

BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

LOCATION.—In SE. ¼ sec. 5, T. 2 N., R. 14 E., at Webb's ranch, about 4 miles below junction of forks of Big Timber Creek and 9 miles northwest of Big Timber, in Sweetgrass County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 13, 1912, to September 30, 1916.

GAGE.—Chain gage on left bank below lower barns, and about one-eighth mile below house at Webb's ranch; read by L. E. Webb.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge about a mile below gage.

CHANNEL AND CONTROL.—Stream bed and banks both below and above the gage change at each high stage. Principal control is a bar that produces riffle extending diagonally across the creek from 30 to 40 feet below gage, and is moving gradually upstream.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 4.65 feet June 20, (discharge 768 second-feet); minimum stage recorded 3.0 feet November 20–21 (discharge 12 second-feet).

1912–1916: Maximum stage recorded, 4.8 feet June 5, 1914 (discharge, 937 second-feet); minimum stage, 2.65 feet March 20, 1915 (discharge, 7 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Much water is diverted for irrigation above and below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed by high water during June, 1916. Rating curve used before June 18 well defined below 400 second-feet, and poorly defined above; curve used after July 4 fairly well defined below 125 second-feet, and poorly defined above. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage heights to rating tables, except for periods during which stage-discharge relation is affected by shifting control, or ice, as shown in footnote to daily-discharge table. Records good except for the high-water period of June, and the month of July.

Discharge measurements of Big Timber Creek near Big Timber, Mont., during the year ending Sept. 30, 1916.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
11	3.22	37.1	May 24	3.70	130	June 27[a]	3.92	527
[illegible]	3.14	26.9	June 10[a]	4.20	346	Aug. 3	3.76	102

[a] Measured from bridge 1 mile below gage.

Daily discharge, in second-feet, of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	56	29			48	83	146	400	126	42
	56	29			48	74	130	400	112	35
	48	29			42	74	105	430	100	35
	48	29			48	74	105	300	100	35
	48	29	23		64	83	200	257	88	35
	48	29	23		56	94	162	234	126	35
	48	29	23		56	200	146	234	112	35
	48	23	23		56	118	162	234	100	35
	48	23	23		56	94	200	282	88	29
	42	23	23		48	83	346	192	88	29
	42	23	23		56	83	376	199	88	35
	42	23		42	83	74	292	206	78	35
	42	23		48	83	48	319	212	78	35
	42	23		56	83	64	346	173	68	35
	42	23		35	83	64	435	156	68	35
	42	23		42	83	64	496	234	68	35
	35	23		42	83	64	593	234	68	35
	35	23		42	83	64	731	212	68	35
	35	23		48	83	83	731	192	59	29
	35	12		48	105	118	768	156	59	29
	35	12		48	64	118	528	173	59	23
	35	29		48	64	118	465	126	59	23
	35	29		74	56	105	435	140	50	23
	35	42		56	74	105	435	126	50	23
	35	29		48	64	105	435	126	50	23
	35	29		56	64	118	528	126	50	23
	35	29		64	83	105	527	140	42	23
	29	28		64	94	105	600	156	42	23
	29	27		64	83	118	500	173	42	23
	23	26		48	83	130	400	126	42	23
	29			56		130		126	42	

NOTE.—Stage-discharge relation affected by ice Nov. 28 to Dec. 4, Dec. 12–13, and Mar. 1–11. Discharge interpolated Nov. 28–30 and July 11–12. June 18–26 discharge determined indirectly on basis of observer's notes and measurement of June 27; June 28 to July 4, on basis of observer's notes, and by comparison with daily discharge of Sweetgrass Creek above Melville. No gage-height record Dec. 14 to Feb. 29.

Monthly discharge of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	56	23	39.9	2,450
November	42	12	25.7	1,530
March 12–31	74	35	51.4	2,040
April	105	42	69.2	4,120
May	200	48	95.5	5,870
June	768	105	388	23,100
July	430	126	209	12,900
August	126	42	73.2	4,500
September	42	23	30.4	1,810

BOULDER RIVER NEAR CONTACT, MONT.

Location.—In SE. ¼ sec. 14, T. 3 S., R. 12 E., at private wagon bridge on ranch of G. W. Baker, 2½ miles below Boulder Falls, and about 8 miles above McLeod post office, 4 miles from Contact, in Sweetgrass County.

Drainage area.—234 square miles.

Records available.—May 1, 1910, to September 16, 1916, when station was discontinued.

Gage.—Vertical staff fastened to downstream side of left abutment of private wagon bridge near the barns on the ranch of G. W. Baker, by whom gage is read.

Discharge measurements.—Made from bridge or by wading at a ford about 400 yards above gage.

Channel and control.—Stream bed rocky; shifts slightly. Right bank high and not subject to overflow; left bank low but is overflowed only in extreme floods.

Extremes of discharge.—Maximum stage recorded during year, 8.4 feet, 7 a. m. June 27 (discharge, 4,750 second-feet); minimum stage recorded, 2.25 feet November 15 (discharge, 78 second-feet).

1910–1916: Maximum stage recorded June 27, 1916; minimum stage recorded, 1.9 feet November 22–24, 1914, and March 21–24, 1915 (discharge, 20 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Small ditch diverts for irrigation above station.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve fairly well defined. Gage read to half tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records only fair, owing to lack of discharge measurements.

The following discharge measurement was made by C. S. Heidel:

October 22, 1916: Gage height, 2.59 feet; discharge, 152 second-feet.

Daily discharge, in second-feet, of Boulder River near Contact, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	140	165	....	435	3,450	590	265
2	140	165	....	510	3,450	590	230
3	152	140	....	485	3,550	535	265
4	180	140	....	435	2,720	535	230
5	140	128	....	485	2,630	510	230
6	165	128	....	510	3,650	485	265
7	165	128	....	485	2,900	435	248
8	165	128	....	535	3,260	435	230
9	165	115	....	618	2,990	390	230
10	140	102	....	535	2,990	368	180
11	152	115	....	765	2,540	435	195
12	152	90	....	735	2,460	435	230
13	165	90	....	1,260	2,380	535	230
14	165	90	....	1,040	2,290	485	195
15	152	78	....	1,260	2,120	460	165
16	165	....	....	1,330	1,980	435	165
17	165	....	....	1,880	1,850	435	....
18	165	....	....	4,250	1,720	390	....
19	165	....	....	4,450	1,580	368	....
20	152	....	....	4,050	1,440	325	....
21	165	....	....	3,850	1,310	325	....
22	152	....	....	3,450	1,180	305	....
23	152	....	....	3,080	1,040	265	....
24	152	....	....	3,080	965	265	....
25	128	....	....	3,080	895	230	....
26	140	....	....	4,050	895	230	....
27	140	....	....	4,450	830	265	....
28	140	....	....	4,250	765	265	....
29	152	....	390	4,050	735	230	....
30	140	....	405	3,850	675	212	....
31	152	....	420	....	645	265	....

NOTE.—Discharge interpolated, for lack of gage readings, Oct. 31, May 30, 31, and July 16–22.

Monthly discharge of Boulder River near Contact, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	180	128	154	9,470
November 1–15	165	78	120	3,570
June	4,450	435	2,110	126,000
July	3,650	645	2,000	123,000
August	590	212	388	23,900
September 1–16	265	165	222	7,050

SWEETGRASS CREEK ABOVE MELVILLE, MONT.

LOCATION.—About in middle of sec. 27, T. 5 N., R. 13 E., on T. S. Lavold's ranch, 9 miles northwest of Melville, Sweetgrass County.

DRAINAGE AREA.—About 63 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1916; May 5, 1907, to December 31, 1912, for station at C. M. Rein's ranch in SW. ¼ sec. 24., T. 5 N., R. 12 E., 17 miles northwest of Melville. No diversions or tributaries between two stations.

GAGE.—Vertical staff on left bank three-fourths mile above T. S. Lavold's house, read by T. S. Lavold.

DISCHARGE MEASUREMENTS.—Made by wading 100 feet above gage, or from bridge near observer's house.

CHANNEL AND CONTROL.—Stream bed composed of gravel and boulders; probably slightly shifting. Banks high; not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 2.7 feet June 17 (discharge, 872 second-feet); minimum stage, 0.5 foot March 20–23 and April 12–21 (discharge, 13 second-feet).

1907–1912: Maximum stage recorded at old section, 5.15 feet June 1, 1908 (discharge, 1,490 second-feet); minimum stage, 1.42 feet April 18–19, 1911, and April 23–30, 1912 (discharge, 8.6 second-feet).

1913–1916: Maximum stage recorded at present site, 2.7 feet June 4, 1914 (discharge, 1,280 second-feet); minimum stage, 0.45 foot April 29, 1915 (discharge, 11 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Two small ditches divert water above gage; quantity diverted is negligible.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during year. Rating curve well defined below 700 second-feet. Gage read to half tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Sweetgrass Creek above Melville, Mont., during the year ending Sept. 30, 1916.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 20	0.95	49.8	June 10	2.2	508	Aug. 3	1.32	131
May 24	1.24	107	27	2.3	579			

Daily discharge, in second-feet, of Sweetgrass Creek above Melville, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	80	37	27	....	19	19	136	511	149	49
2	80	49	27	....	16	23	136	578	149	49
3	80	49	27	....	19	23	123	578	123	49
4	80	49	27	....	16	23	149	511	136	49
5	80	49	27	....	16	27	247	511	136	49
6	80	49	27	....	16	27	210	393	149	49
7	80	49	27	....	16	27	228	393	149	49
8	80	49	27	....	16	37	210	393	136	49
9	80	49	27	....	16	100	340	578	136	49
10	80	49	27	....	16	80	511	450	123	49
11	80	49	27	....	16	123	340	340	123	49
12	63	49	27	....	13	123	210	340	123	49
13	63	49	27	....	13	123	290	340	123	49
14	63	49	27	....	13	123	340	290	112	49
15	63	37	27	....	13	100	511	247	100	43
16	63	37	37	....	13	100	578	210	100	43
17	63	37	37	....	13	100	872	228	100	43
18	63	37	27	....	13	100	650	247	100	37
19	63	37	27	16	13	123	797	247	90	37
20	56	37	27	13	13	100	578	210	90	37
21	63	37	37	13	13	100	578	178	80	37
22	63	37	37	13	19	100	511	178	80	37
23	63	37	37	13	19	100	450	178	80	37
24	63	37	37	16	19	112	511	178	80	37
25	63	27	27	16	19	123	450	178	80	37
26	49	27	27	16	19	123	511	178	80	37
27	49	27	27	16	19	123	578	164	80	37
28	49	27	27	16	19	123	650	164	80	37
29	37	27	27	16	19	136	578	164	80	37
30	37	27	27	16	19	136	511	164	56	37
31	37	....	27	16	....	136	....	149	49	....

Note.—No gage-height record Jan. 1 to Mar. 18.

Monthly discharge of Sweetgrass Creek above Melville, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	80	37	64.9	3,990
November	49	27	40.2	2,390
December	37	27	28.9	1,780
March 19–31	16	13	15.1	389
April	19	13	16.1	958
May	136	19	90.7	5,580
June	872	123	426	25,300
July	578	149	305	18,800
August	149	49	106	6,520
September	49	37	43.2	2,570

SWEETGRASS CREEK BELOW MELVILLE, MONT.

Location.—Near middle of south line of sec. 27, T. 4 N., R. 15 E., at McAllister's ranch, about one-fourth mile above head of intake canal of Big Timber Carey project, and 6 miles southeast of Melville, Sweetgrass County.

Drainage area.—137 square miles (measured on topographic maps).

Records available.—April 1, 1909, to September 30, 1916; May 4, 1907, to April 1, 1909, at Adam's ranch, 2½ miles downstream.

Gage.—Overhanging chain gage on left bank about 100 feet west of McAllister's ranch house; read by Mrs. Swen Johnson.

Discharge measurements.—Made by wading below gage or from highway bridge one-half mile above gage.

Channel and control.—Stream bed of clean gravel. Bar producing riffle about 300 feet around a bend below gage likely to shift. Right bank low; subject to overflow during high stages; left is a cut bank at the gage and not overflowed at that point, but is lower and may be overflowed about 200 feet below gage.

Extremes of discharge.—Maximum stage recorded during year 4.2 feet during high water in June, as estimated on June 27 from high-water marks (discharge determined from extension of rating curve, 1,700 second-feet); minimum stage recorded, 1.15 feet September 4 (discharge, 34 second-feet).

1909–1916: Maximum stage recorded June 27, 1916; minimum stage recorded, 1.0 foot, August 23–25, September 2–4 and 6, 1913 (discharge, 10 second-feet).

Ice.—Stage-discharge relation seriously affected by ice. Recently no one has lived on the ranch during the winter, and observers have not been available for reading gage even to the end of the open season or to begin as soon as the ice breaks.

Diversions.—There are adjudicated rights from Sweetgrass Creek exceeding 500 second-feet, and numerous ditches divert water both above and below the station. The intake canal of the Big Timber Carey project, which will carry 600 second-feet, diverts into two connecting storage reservoirs, one of 6,000, and the other 12,000 acre-feet capacity.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent during year. Rating curve fairly well defined. Gage read to half tenths daily when observer was home. Discharge obtained by applying gage heights to rating table. Records fair.

Discharge measurements of Sweetgrass Creek below Melville, Mont., during the year ending Sept. 30, 1916.

[Made by C. S. Heidel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 20	1.43	68	June 10	3.00	580	Aug 3	1.45	73
May 24	1.78	122	27	3.22	800			

Daily discharge, in second-feet, of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July	Aug.	Sept.
1			614	84	38	16			187	61	48
2		200	614	76	38	17			174	61	48
3		151	830	68	38	18			215	61	54
4		162	494	61	34	19			151	54	54
5		230	390	61	38	20			151	61	61
6		247	302	76	43	21			110	68	54
7		230	440	61	43	22			120	54	54
8			440	68	43	23			110	61	48
9			440	76	48	24	130		110	54	38
10		614	415	76	48	25	200		101	54	38
11			390	76	54	26	187		101	61	43
12			230	76	54	27	174	752	92	54	38
13			323	68	48	28	174	998	110	54	48
14			247	61	54	29	174	912	130	54	48
15			230	61	48	30		680	110	48	43
						31			92	43	

Monthly discharge of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July	830	92	273	16,800
August	84	43	63.0	3,870
September	61	34	46.2	2,750
The period				23,400

PRYOR CREEK AT COBURN, MONT.

Location.—In SE. ¼ sec. 35, T. 1 S., R. 27 E., on Crow Indian Reservation at Coburn, in Yellowstone County, 12 miles southwest of Billings and 13 miles above mouth of creek.

Drainage area.—Not measured.

Records available.—September 13, 1911, to September 30, 1916.

Gage.—Overhanging chain gage on left bank, opposite observer's house; read by Harry Foster.

Discharge measurements.—Made by wading.

Channel and control.—Bed of stream gravel and clay. Principal control is gravel bar which forms a riffle at low stages about 300 feet below gage; at a medium stage the riffle disappears and no well-defined control exists. Banks high and not subject to overflow except at extremely high stages. Current at gage is sluggish at low stages but of medium velocity at high stages.

Extremes of discharge.—Maximum stages recorded during year, 7.01 feet at 6 p. m. May 22 (discharge, 333 second-feet); minimum stage, 3.9 feet July 15–27, August 3–6 and 11–14 (discharge, 25 second-feet).

1911–1916: Maximum stage recorded, 9.9 feet, May 20, 1912 (discharge, 746 second-feet); minimum stage, 3.6 feet September 1, 1913 (discharge, 6 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Water sufficient to irrigate approximately 1,000 acres near Pryor is diverted about 30 miles above Coburn.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 14 and 282 second-feet. Gage read to half tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Pryor Creek at Coburn, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 23	4.30	67
May 22	5.05	136
July 25	3.91	25.2

Daily discharge, in second-feet, of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	49	49	....	88	78	133	49	36	40
2	49	49	....	116	83	146	49	32	40
3	58	49	....	219	83	199	44	25	32
4	88	49	....	158	73	121	40	25	32
5	68	49	....	99	68	140	40	25	32
6	49	49	....	88	68	121	40	25	40
7	49	49	....	88	73	121	40	28	40
8	49	49	....	83	78	110	40	25	40
9	49	49	....	68	78	110	32	28	40
10	49	49	....	68	78	110	32	28	58
11	49	49	....	68	78	104	32	25	49
12	49	49	....	73	83	99	32	25	49
13	49	49	....	68	121	99	32	25	49
14	49	49	....	68	179	99	32	25	49
15	49	49	....	68	219	88	25	25	49
16	49	49	....	68	273	88	25	28	49
17	49	49	....	73	238	88	25	32	49
18	49	49	....	68	180	88	25	32	49
19	49	49	....	68	121	83	25	32	40
20	49	49	....	68	133	78	25	32	40
21	49	....	....	68	140	99	25	32	40
22	49	....	....	73	273	133	25	32	40
23	49	....	68	68	273	110	25	40	40
24	49	....	63	68	219	88	25	40	40
25	49	....	73	68	255	88	25	40	40
26	49	....	83	68	229	78	25	40	40
27	49	....	83	73	179	68	25	40	40
28	49	....	83	68	152	63	32	40	40
29	49	....	78	68	146	58	58	40	40
30	49	....	78	78	146	54	78	40	40
31	49	....	78	....	140	....	54	40	....

NOTE.—Gage not read Dec. 16 to Mar. 22. Stage-discharge relation affected by ice after Nov. 20.

Monthly discharge of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet)
	Maximum.	Minimum.	Mean.	
October	88	49	51.2	3,150
November 1-20	49	49	49.0	1,940
March 23-31	83	68	76.3	1,360
April	219	68	82.0	4,880
May	273	68	147	9,040
June	199	54	102	6,070
July	78	25	34.9	2,150
August	40	26	31.7	1,950
September	58	32	42.2	2,510

PRYOR CREEK AT HUNTLEY, MONT.

Location.—In SW. ¼ sec. 25, T. 2 N., R. 27 E., at steel highway bridge half a mile from railroad station at Huntley, in Yellowstone County.

Drainage area.—800 square miles.

Records available.—August 6, 1904, to December 30, 1916, when station was discontinued.

Gage.—Chain, installed June 16, 1906, at highway bridge crossing the new channel, into which the creek was at that time turned by the United States Reclamation Service; read by E. V. Carpenter, E. C. Peterson, and George Ditz, employees of the United States Reclamation Service. From August 6, 1904, to June 16, 1906, observations were made from staff gage on right bank 200 feet south of Northern Pacific Railway station. The two gages are not set to the same datum.

Discharge measurements.—Made by wading or from bridge to which gage is attached.

Channel and control.—Bed composed of clay and gravel; may change somewhat; banks steep and uniformly graded, clean, and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 8.85 feet February 18 (stage-discharge relation affected by ice; discharge not determined); minimum stage recorded, 1.10 feet July 25-26 (discharge, 13 second-feet).

1904-1916: Maximum open-water stage recorded, 7.2 feet July 3, 1912 (discharge, 1,560 second-feet); channel reported dry July 26-28, 1908.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Water sufficient to irrigate about 1,100 acres is diverted above station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by ice and by shifting control. Rating curve used October 1 to November 4, 1915, fairly well defined; curve used March 16 to December 15, 1916, well defined between 20 and 200 second-feet. Gage read to quarter tenths before March 1, and to hundredths after that date, once daily. Discharge ascertained by applying daily gage height to rating table. No record November 5 to December 31, 1915; gage read but data inadequate for determination of flow January 1 to March 15, and December 11-30, 1916. Records fair.

Discharge measurements of Pryor Creek at Huntley, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 23	1.67	76
May 31	2.17	152
Aug. 5	1.30	30.5

Daily discharge, in second-feet, of Pryor Creek at Huntley, Mont., for the period Oct. 1, 1915, to Dec. 10, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	282	36	....	79	75	178	72	38	30
2	40	36	....	188	75	168	69	35	30
3	40	36	....	239	72	159	65	30	32
4	40	36	....	198	69	141	65	30	32
5	40	....	....	141	68	124	62	28	33
6	40	....	....	108	65	124	61	26	35
7	40	....	....	100	68	141	58	28	35
8	40	....	....	93	69	124	56	30	35
9	40	....	....	93	72	124	52	32	37
10	40	....	....	86	68	116	51	32	38
11	40	....	....	86	65	116	46	35	40
12	40	....	....	79	69	116	40	35	40
13	40	....	....	65	72	108	35	35	42
14	40	....	....	76	159	108	33	33	44
15	40	....	....	79	260	100	30	33	44
16	40	....	305	82	218	100	30	30	46
17	40	....	260	86	178	96	28	30	46
18	38	....	239	86	159	93	26	29	48
19	36	....	198	82	159	86	23	28	46
20	36	....	188	79	124	82	21	27	46
21	36	....	168	76	198	79	17	26	44
22	36	....	141	72	228	93	17	26	42
23	36	....	93	69	218	105	17	24	40
24	38	....	100	68	218	116	15	23	40
25	40	....	79	69	218	108	13	22	42
26	40	....	79	72	208	105	13	21	44
27	38	....	86	75	198	100	17	23	44
28	36	....	93	78	198	93	26	26	46
29	36	....	86	79	188	86	124	26	46
30	36	....	82	76	178	76	46	27	47
31	36	....	79	....	159	....	42	28	....

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1916.				1916.				1916.			
1	50	75	72	11	68	62	....	21	108	75	....
2	52	72	72	12	69	62	....	22	105	72	....
3	55	71	69	13	72	65	....	23	100	72	....
4	55	69	69	14	72	68	....	24	98	69	....
5	56	68	68	15	76	69	....	25	93	68	....
6	58	68	65	16	79	72	....	26	89	65	....
7	58	66	65	17	86	72	....	27	83	68	....
8	61	65	64	18	89	75	....	28	79	68	....
9	62	65	62	19	93	76	....	29	79	69	....
10	65	65	65	20	100	76	....	30	76	72	....
								31	75	....	....

Monthly discharge of Pryor Creek at Huntley, Mont., for the period Oct. 1, 1915, to Dec. 10, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	282	36	46.5	2,860
November 1–4	36	36	36.0	286
March 16–31	305	79	142	4,510
April	239	65	95.3	5,670
May	260	65	141	8,670
June	178	76	112	6,660
July	124	13	41.0	2,520
August	38	21	28.9	1,780
September	48	30	40.5	2,410
1916.				
October	108	50	76.2	4,690
November	76	62	69.3	4,120
December 1–10	72	62	67.1	1,330

WIND RIVER AT RIVERTON, WYO.

Location.—In sec. 2, T. 1 S., R. 4 E., at highway bridge one mile east of Riverton, in Fremont County. Popo Agie River enters three-fourths mile below.

Drainage area.—2,320 square miles (measured on base map of Wyoming, scale 1:500,000.)

Records available.—May 15, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916. From May 14, 1906, to November 1, 1908, a station was maintained at Walker's ferry, about a mile above the present station. No streams enter between the sites; records directly comparable.

Gage.—Chain gage on downstream side of first pier from left bank; read by Miss Edna Grider.

Discharge measurements.—Made from bridge.

Channel and control.—Bed composed of sand and gravel, somewhat shifting. No well-defined control. Right bank subject to overflow at extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 10.1 feet at 6.30 p. m. June 18, and 5 p. m. June 19 (discharge, 7,750 second-feet); minimum discharge occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Water is diverted from Wind River and its tributaries to irrigate about 20,000 acres, an area which, under the Wyoming law allowing one second-foot for 70 acres, would require 286 second-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent but shifts between narrow limits. Rating curve well defined between 500 and 6,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Wind River at Riverton, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage ht.	Discharge.
		Feet.	*Sec.-ft.*				*Sec.-ft.*
Oct. 11	M. N. Grant, jr.	5.59	979	May 8	R. H. Fletcher	[illegible]	2,370
Jan. 16	R. I. Meeker	[a]5.95	266	June 15	H. K. Smith	[illegible]	4,760
Feb. 25	R. H. Fletcher	[a]5.86	450	Sept. 1	P. V. Hodges	[illegible]	1,130

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Wind River at Riverton, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	1,530	....	422	1,090	2,570	5,160	2,850	1,010
	1,440	....	478	970	2,320	5,160	2,570	1,010
	1,350	....	498	930	2,090	5,160	2,320	1,010
	1,260	....	440	970	2,570	4,980	2,090	1,010
	1,180	....	440	1,340	3,600	4,450	2,090	1,010
	1,260	....	478	1,880	3,920	4,450	2,850	1,010
	1,100	....	440	2,200	3,290	4,450	2,710	930
	960	....	440	2,320	3,440	4,450	2,440	930
	960	855	459	2,090	4,090	4,800	2,710	855
	960	1,510	459	2,200	5,160	4,800	2,710	785
	960	1,090	498	2,090	5,160	4,450	2,440	785
	960	855	586	1,880	5,530	4,260	2,090	753
	835	785	636	1,690	5,160	4,090	1,980	663
	835	930	540	1,510	4,980	3,920	1,880	610
	835	636	586	1,340	5,530	3,760	1,880	610
	895	518	785	1,170	5,720	4,090	1,690	562
	835	540	692	1,010	6,700	3,920	1,690	586
	780	663	636	930	7,120	3,920	1,600	562
	780	785	636	930	7,120	3,760	1,510	518
	780	721	562	1,010	6,910	3,440	1,420	518
	675	586	498	1,340	6,700	3,140	1,420	498
	725	636	540	1,510	5,910	2,850	1,340	478
	....	562	498	1,340	4,450	2,850	1,170	478
	....	530	518	1,340	3,760	2,850	1,090	478
	....	498	586	1,340	3,600	2,710	1,010	478
	....	459	892	1,260	3,760	2,710	970	478
	....	440	1,340	1,260	4,450	3,140	970	478
	....	440	1,510	1,260	5,160	3,140	970	478
	....	518	1,690	1,260	5,910	3,140	970	478
	....	459	1,170	1,690	5,530	3,290	1,010	478
	....	422	....	2,200	....	2,850	1,010	....

Monthly discharge of Wind River at Riverton, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1–22	1,530	675	995	43,400
March 9–31	1,510	422	671	30,600
April	1,690	422	665	39,600
May	2,320	930	1,460	89,800
June	7,120	2,090	4,740	282,000
July	5,160	2,710	3,880	239,000
August	2,850	970	1,790	110,000
September	1,010	478	684	40,700

BIG HORN RIVER AT THERMOPOLIS, WYO.

Location.—In sec. 19, T. 43 N., R. 95 W., at highway bridge between Thermopolis and Hot Springs, in Hot Springs County. Nearest tributary, Buffalo Creek, enters 3 miles upstream.

Drainage area.—8,080 square miles (measured on base map of Wyoming, scale, 1:500,000).

Records available.—May 28, 1900, to December 31, 1905; June 30, 1910, to October 7, 1912; April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

shifting

Gage.—Chain gage on downstream handrail of brid of Shoshone River at

1 foot lower than staff gage used previously bles, good; others fair.

Discharge measurements.—Made from two-

Channel and control.—Bed composed of co

trol a short distance below gage; practically pe

control is canyon entrance half a mile down stream.

ject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 9.25 feet at 8 a. m. June 21 (discharge, 13,000 second-feet); minimum discharge occurs during winter months.

Ice.—Warm springs keep river practically free from ice.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 41 second-feet from Big Horn River above the station and 202 second-feet below. In addition, an adjudicated permit of 336 second-feet for power above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent but shifts between narrow limits; not seriously affected by ice during the year. Rating curve well defined between 900 and 12,000 second-feet but poorly defined below. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Big Horn River at Thermopolis, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	M. N. Grant, jr.	[a] 1.70	1,730	June 12	H. K. Smith	6.58	8,310
Feb. 26	R. H. Fletcher	[b] 1.93	931	July 26	.....do	3.72	3,510
May 4	.....do	[b] 2.76	1,950				

[a] Refers to old datum, 1.0 foot higher than that established May 4, 1916.

[b] 1.0 foot added to observed gage heights to refer them to datum established May 4.

Daily discharge, in second-feet, of Big Horn River at Thermopolis, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,110	1,180	....	800	1,280	3,190	3,360	8,300	3,020	1,180
2	2,700	1,180	....	720	1,280	2,200	3,680	7,480	3,190	1,180
3	2,530	1,180	....	720	1,180	1,880	3,520	7,150	3,190	1,080
4	2,360	1,180	....	720	1,180	1,880	3,520	7,150	3,360	1,080
5	2,360	1,180	....	720	1,280	1,740	3,850	6,820	3,520	1,180
6	2,280	1,180	....	890	1,180	2,200	4,680	6,160	3,020	1,180
7	1,960	1,080	....	1,390	1,180	2,860	6,160	6,160	3,190	1,180
8	1,880	980	....	1,280	1,180	3,520	6,490	6,160	3,190	1,130
9	1,880	980	....	1,280	1,130	3,850	5,170	6,000	3,190	1,080
10	1,880	980	....	1,390	1,080	3,680	5,830	6,000	3,190	980
11	1,880	980	....	1,620	980	3,680	7,150	6,160	3,020	980
12	1,810	980	....	1,880	980	3,520	8,140	5,830	2,860	980
13	1,740	980	....	1,620	1,180	3,190	8,140	5,500	2,530	980
14	1,740	800	....	1,500	1,180	3,190	7,480	5,660	2,530	980
15	1,620	685	....	1,500	1,180	2,860	7,480	5,170	2,200	935
16	1,620	600	....	1,390	1,280	2,200	7,980	5,340	2,200	890
17	1,620	600	....	1,280	1,280	2,040	8,800	5,170	2,040	800
18	1,500	560	....	1,390	1,180	1,880	10,300	5,170	1,880	760
19	1,500	540	....	1,390	1,180	1,880	11,800	5,000	1,740	760
20	1,500	540	980	1,740	1,180	1,880	12,400	5,000	1,740	760
21	1,390	485	980	1,740	1,180	1,880	12,400	4,510	1,740	720
22	1,280	485	890	1,620	1,180	2,360	11,400	4,510	1,620	720
23	1,280	440	800	1,500	1,180	2,530	9,790	4,180	1,620	720
24	1,280	440	800	1,500	1,180	2,360	6,980	3,910	1,390	685
25	1,280	440	800	1,500	1,180	2,360	5,830	3,630	1,280	685
26	1,340	440	800	1,390	1,180	2,200	5,340	3,360	1,280	686
27	1,390	440	800	1,390	1,500	2,200	5,500	3,360	1,280	720
28	1,280	440	890	1,390	1,880	2,040	6,320	3,360	1,280	720
29	1,280	440	845	1,180	3,190	1,880	7,480	3,360	1,280	720
30	1,280	440	....	1,390	3,190	2,200	8,470	3,190	1,280	720
31	1,280	....	....	1,390	....	2,530	....	3,190	1,230	....

Note.—Discharge Nov. 29, 30, and July 24, 25, estimated.

Monthly discharge of Big Horn River at Thermopolis, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,110	1,280	1,740	107,000
November	1,180	440	762	45,300
February 28-29	960	800	858	17,000
March	1,880	720	1,330	81,800
April	3,190	980	1,350	80,300
May	3,850	1,740	2,510	154,000
June	12,400	3,360	7,180	427,000
July	8,300	3,190	5,220	321,000
August	3,520	1,230	2,260	139,000
September	1,180	685	906	53,900

BIG HORN RIVER NEAR HARDIN, MONT.

LOCATION.—In SW. ¼ sec. 13, T. 1 S., R. 33 E., at bridge of Chicago, Burlington & Quincy Railroad on Crow Indian Reservation, about half a mile above junction of Big Horn and Little Horn Rivers, 2 miles from Hardin, in Big Horn County.

DRAINAGE AREA.—20,700 square miles.

RECORDS AVAILABLE.—June 16, 1904, to September 30, 1916.

GAGE.—Chain gage attached to west span, upstream side of railroad bridge; read by H. R. Kean. A temporary staff gage 20 feet farther downstream was used October 11 to November 22, 1913, and the readings were reduced to datum of chain gage.

DISCHARGE MEASUREMENTS.—Made from railroad bridge.

CHANNEL AND CONTROL.—Stream bed gravel; free from vegetation; slightly shifting. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.05 feet, June 21 (discharge, 31,400 second-feet); minimum stage recorded, 2.65 feet December 3, 1915 (discharge, 1,520 second-feet).

1904–1916: Maximum stage recorded, 9.8 feet June 17, 1908 (discharge, 40,800 second-feet); minimum stage recorded, 2.0 feet November 11, 12, 1911 (discharge, 370 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Water is diverted a few miles above station by a private irrigation company to irrigate land on west side of river. Water is also diverted from Shoshone River at Corbett dam, Wyoming, by the United States Reclamation Service, and many private ditches divert water from tributaries above the station.

REGULATION.—Shoshone reservoir above Cody controls the flow of Shoshone River, an important tributary of the Big Horn.

ACCURACY.—Stage-discharge relation not permanent during year. Three fairly well defined rating curves used, applicable as follows: October 1 to December 30, March 15 to June 21, and July 18 to September 30. Gage read to half tenths once daily except during periods of high water when it was read twice daily. Discharge ascertained by applying mean daily gage height to rating tables except for period June 22 to July 17, for which it was determined by shifting-control method and by hydrographic comparison with record of flow of Shoshone River at Corbett dam, Wyo. Records obtained by use of rating tables, good; others fair.

Discharge measurements of Big Horn River near Hardin, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 2	5.00	7,220
Aug. 7	4.90	5,590

Daily discharge, in second-feet, of Big Horn River near Hardin, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July	Aug.	Sept.
1	7,320	3,010	2,140		2,660	4,220	6,300	20,100	6,920	2,040
2	6,550	2,890	1,770		2,900	4,500	7,260	20,100	6,920	1,940
3	7,320	2,890	1,520		3,030	4,360	7,260	19,400	6,220	2,040
4	10,800	2,770	1,770		3,160	4,220	7,260	18,700	6,220	2,040
5	5,860	2,770	1,960		2,780	3,680	7,260	18,000	5,560	2,140
6	5,860	2,660	2,340		2,660	3,680	7,940	17,300	6,220	2,340
7	5,210	2,660	2,440		2,540	4,220	9,080	16,600	5,560	2,340
8	5,210	2,660	2,550		2,540	4,800	9,500	15,900	5,260	2,340
9	4,600	2,660	2,660		2,540	5,400	9,500	15,200	5,560	2,340
10	4,600	2,770	2,660		2,540	5,700	10,400	14,500	5,560	2,240
11	4,600	2,770	2,660		2,540	6,620	13,600	13,900	5,260	2,140
12	4,310	2,770	2,770		2,420	6,620	15,300	13,300	5,260	2,430
13	4,310	2,770	2,890		2,420	6,940	15,800	12,700	5,260	2,340
14	4,030	3,250	2,770		2,420	6,620	15,800	12,100	4,960	2,340
15	4,030	3,010	2,550	4,800	2,420	6,000	16,400	11,500	4,660	2,340
16	4,030	2,890	2,140	4,500	3,030	5,700	15,300	10,900	4,380	2,340
17	4,030	2,890	2,140	3,940	3,290	5,100	19,400	10,300	4,100	2,340
18	4,030	2,770	2,140	4,220	3,160	4,500	22,100	9,700	3,540	2,340
19	4,030	2,660		3,940	3,030	4,220	25,000	11,900	3,540	2,340
20	3,760	2,550		3,680	3,080	3,680	28,000	11,400	3,150	2,340
21	3,760	2,550		4,220	3,160	4,220	31,000	10,500	3,020	2,340
22	3,500	2,550		3,420	3,160	5,700	28,700	9,700	3,020	2,240
23	3,500	2,660		3,420	3,160	5,400	26,900	9,280	3,020	2,140
24	3,500	2,770		3,420	2,780	5,700	23,100	8,860	2,780	2,140
25	3,500	2,550		3,290	2,660	5,700	18,300	8,460	2,560	2,140
26	3,500	2,660		3,160	2,540	6,000	15,800	8,060	2,450	2,240
27	3,500	2,550		3,160	2,540	5,400	14,700	7,680	2,450	2,240
28	3,250	2,550		3,160	2,660	5,400	15,500	7,300	2,430	2,140
29	3,130	2,550		3,030	3,420	5,100	18,100	7,300	2,220	2,140
30	3,130	2,140		2,900	4,220	4,800	19,900	6,920	2,140	1,240
31	3,130			2,660		5,400		6,920	2,040	

NOTE.—Observer noted the presence of slush ice Dec. 1–6. Determination of discharge, Dec. 1–18, may be too large, owing to possible backwater from ice.

Monthly discharge of Big Horn River near Hardin, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	10,800	3,130	4,580	282,000
November	3,250	2,140	2,720	162,000
December 1–18	2,890	1,520	2,330	83,200
March 15–31	4,800	2,660	3,580	121,000
April	4,220	2,420	2,860	170,000
May	6,940	3,680	5,150	317,000
June	31,000	6,300	16,000	952,000
July	20,100	6,920	12,400	762,000
August	6,920	2,040	4,270	263,000
September	2,430	1,940	2,230	133,000

POPO AGIE RIVER BELOW ARAPAHOE, WYO.[a]

Location.—In sec. 23, T. 1 S., R. 3 E., at highway bridge half a mile below Arapahoe, in Fremont County. Nearest tributary, Little Wind River, enters 200 yards above. Popo Agie River enters Wind River 6 miles below.

Drainage area.—1,530 square miles (measured on base map of Wyoming, scale 1:500,000).

Records available.—May 11, 1906, to November 27, 1909; May 14, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916.

Gage.—Vertical staff on downstream side of first pier from left bank; read by R. H. Knox. From June 19 to July 19, 1911, a temporary gage was used with datum 2.95 feet higher; during 1915 a temporary gage was used with datum 0.55 foot higher. All readings have been reduced to the original datum.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed composed of sand and gravel. Control slightly shifting from year to year. Right bank will be overflowed at extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 6.2 feet at 6 p. m. June 19 (discharge, 4,400 second-feet); minimum stage recorded, 0.99 foot at 5.45 p. m. September 21 (discharge, 107 second-feet).

Diversions.—Between this station and that on Little Wind above Arapahoe prior to December 31, 1916, there were adjudicated diversions of 583 second-feet from the Popo Agie and its tributaries.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent, but shifts between very narrow limits; affected by ice during winter. Rating curve well defined between 100 and 7,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent, except those for October, November, and March, which are good.

Discharge measurements of Popo Agie River below Arapahoe, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	M. N. Grant, jr	2.40	594	June 14	H. K. Smith	4.74	2,530
Jan. 15	R. I. Meeker	[b]2.40	154	Aug. 31	Follansbee and Hodges	1.18	146
May 7	R. H. Fletcher	3.76	1,760				

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[a] Formerly known as Little Wind River below Arapahoe, Wyo.

[b] Stage discharge relation affected by ice.

Daily discharge, in second-feet, of Popo Agie River below Arapahoe, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,000	344	....	252	625	1,280	2,160	518	147
2	935	344	....	235	625	1,130	2,160	469	149
3	870	344	....	252	625	1,130	2,160	423	133
4	870	321	....	252	598	1,440	1,960	380	129
5	806	321	....	235	770	1,960	1,690	340	151
6	744	321	....	235	1,130	2,160	1,600	380	129
7	744	300	....	252	1,520	1,780	1,600	423	125
8	684	300	....	235	1,360	1,870	1,520	380	125
9	655	300	....	220	1,360	2,360	1,780	380	117
10	655	300	....	204	1,360	2,760	1,780	423	121
11	626	280	....	220	1,200	2,760	1,600	402	136
12	626	280	....	284	1,130	2,560	1,440	380	149
13	570	280	....	303	1,060	2,460	1,360	322	144
14	570	....	....	286	1,130	2,360	1,280	286	144
15	570	....	....	286	860	2,560	1,280	268	142
16	543	....	....	322	800	2,980	1,440	235	144
17	543	....	....	340	770	3,480	1,280	220	131
18	543	....	340	340	711	3,930	1,280	190	125
19	516	....	235	340	682	4,100	1,200	176	121
20	516	....	220	340	800	3,770	990	164	115
21	516	....	235	303	990	2,760	860	176	109
22	490	....	360	286	1,060	2,560	800	176	111
23	464	....	322	286	925	1,960	682	164	119
24	464	....	268	303	860	1,600	682	151	117
25	439	....	268	360	800	1,780	625	268	113
26	439	....	268	446	740	1,870	682	164	109
27	414	....	268	570	682	2,160	625	151	111
28	390	....	303	711	682	2,560	625	151	117
29	390	....	303	800	800	2,760	654	151	123
30	366	....	268	682	925	2,460	625	147	109
31	366	....	268	....	1,130	....	598	147	....

Monthly discharge of Popo Agie River below Arapahoe, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,000	366	591	36,300
November 1–13	344	280	310	7,990
March 18–31	360	220	280	7,780
April	800	204	339	20,200
May	1,520	625	926	56,900
June	4,100	1,130	2,380	142,000
July	2,160	598	1,260	77,500
August	518	147	278	17,100
September	151	109	127	7,560

LITTLE POPO AGIE RIVER AT HUDSON, WYO.

Location.—About sec. 12, T. 2 S., R. 2 E., at highway bridge three-eighths mile southwest of Hudson, in Fremont County. No tributary between station and mouth of river, half mile below.

Drainage area.—346 square miles (measured on base map of Wyoming, scale 1 : 500,000).

Records available.—August 26, 1907, to December 31, 1909; June 19, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916.

Gage.—Vertical staff on center pier of bridge, installed August 25, 1915, at a datum 1 foot higher than that of original gage, a staff fastened to the right abutment of bridge and used from August 26, 1907, to June 12, 1908; June 13, 1908, chain gage was installed 100 yards downstream from bridge and at a new datum; chain gage was abandoned July 24, 1912, and readings were resumed on the original gage, which was also used from April 1 to August 25, 1915. Gage read by Miss Alice Ladd.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel washed in from new channel cut above station during winter of 1915, control is at gage; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.65 feet at 5.30 p. m. June 19 (discharge 584 second-feet); minimum discharge occurs during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 1, 1916, adjudicated diversions from Little Popo Agie River above the station amounted to 50 second-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in May and June; apparently permanent for remainder of year. Rating curve used before the change in control, fairly well defined, curve used after change, well defined between 30 and 800 second-feet; applied indirectly October 1 to November 26, and May 6 to June 21. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting control method used May 7 to June 13. Records good except those obtained by shifting-control method which are fair.

Discharge measurements of Little Popo Agie River at Hudson, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
11	M. N. Grant, jr.	1.10	89
6	R. H. Fletcher	2.22	288
14	H. K. Smith	2.72	348
31	Follansbee and Hodges	.74	38.1

Daily discharge, in second-feet, of Little Popo Agie River at Hudson, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
	110	79	83	192	222	272	48	40
	117	78	78	212	212	261	55	41
	110	82	86	202	232	261	46	41
	110	78	86	202	264	261	42	42
	103	79	82	222	328	222	42	41
	103	78	84	296	306	204	46	40
	96	78	88	362	264	196	44	41
	96	78	80	362	285	204	42	41
	90	78	78	384	350	241	37	39
	90	77	77	362	396	241	37	39
	90	71	90	339	419	196	37	41
	88	59	110	317	396	187	36	42
	84	72	110	296	396	178	37	42
	85	78	103	285	393	154	37	42
	85	85	110	254	393	154	38	42
	88	84	103	222	466	170	39	42
	88	79	117	202	517	146	35	46
	88	84	117	192	517	132	37	46
	88	90	124	183	543	132	37	45
	86	90	117	192	517	112	38	42
	84	78	117	243	417	100	37	42
	83	78	110	254	370	82	38	42
	83	77	110	243	303	72	38	42
	82	78	117	232	241	82	39	44
	80	76	132	212	261	72	39	42
	80	67	156	192	282	61	39	43
	80	....	192	183	282	57	42	44
	80	....	222	192	325	48	41	44
	80	....	232	192	347	77	41	46
	80	....	212	192	325	77	42	46
	80	....	....	212	....	66	41	....

Monthly discharge of Little Popo Agie River at Hudson, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	117	80	89.9	5,530
November 1-26	90	59	78.1	4,030
April	232	77	117	6,960
May	384	183	246	15,100
June	543	212	352	20,900
July	272	48	152	9,350
August	55	35	40.2	2,470
September	46	39	42.3	2,520

LITTLE WIND RIVER ABOVE ARAPAHOE, WYO.

Location.—In sec. 23, T. 1 S., R. 3 E., at railroad bridge opposite Indian subagency a quarter of a mile above Arapahoe, in Fremont County. Little Wind River enters Popo Agie River a quarter of a mile below.

Drainage area.—716 square miles (measured on base map of Wyoming, scale 1:500,000).

Records available.—May 14, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916. May 11, 1906, to December 17, 1909, for station a short distance above present site; flow directly comparable.

Gage.—Chain gage on upstream side of railroad bridge; read by R. H. Knox.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of sand and gravel. Control a short distance downstream from gage; permanent during 1916. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 5.1 feet at 5.45 p. m. June 19 (discharge, 1,870 second-feet); minimum stage, 1.58 feet at 7.20 a. m. September 29 (discharge, 24 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Water is diverted from Little Wind River and tributaries to irrigate about 15,000 acres, an area which would require, under the Wyoming law allowing one second-foot for 70 acres, 214 second-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined between 40 and 3,000 second feet; extended beyond these limits. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent except those for October, November, and March, which are good.

Discharge measurements of Little Wind River above Arapahoe, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	M. N. Grant, jr.	2.85	213	May 7	R. H. Fletcher	3.45	501
Jan. 15	R. I. Meeker	[a] 2.82	47.8	June 14	H. K. Smith	4.07	874
Feb. 26	R. H. Fletcher	[a] 3.80	105	Aug. 31	P. V. Hodges	2.01	48.9

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Little Wind River above Arapahoe, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	401	98	....	72	120	445	955	230	49
2	390	94	....	72	100	445	915	192	53
3	365	94	....	74	110	445	915	160	49
4	340	86	....	74	103	530	878	145	50
5	295	86	....	74	118	730	765	132	46
6	272	86	....	75	272	995	730	145	44
7	250	86	....	75	365	765	695	160	42
8	242	86	....	76	365	765	695	145	40
9	203	80	....	78	318	955	765	160	39
10	175	80	....	69	365	1,160	802	175	38
11	182	74	....	65	295	1,160	765	175	40
12	175	74	....	70	250	1,080	695	175	46
13	175	....	....	84	250	1,040	625	160	46
14	175	....	....	76	250	915	592	120	47
15	175	....	....	72	210	995	560	109	39
16	160	....	....	76	175	1,160	660	101	47
17	160	....	....	84	145	1,440	625	96	38
18	160	....	....	75	132	1,540	592	84	37
19	160	....	....	74	120	1,760	560	73	33
20	160	....	86	72	145	1,650	500	70	31
21	160	....	94	64	250	1,350	390	69	29
22	145	....	132	52	210	1,160	365	69	28
23	145	....	101	52	210	878	295	64	28
24	145	....	98	50	175	660	295	60	28
25	132	....	94	52	175	660	250	55	26
26	125	....	86	62	160	730	295	51	25
27	120	....	86	89	145	878	295	51	26
28	110	....	86	120	120	1,080	295	51	25
29	105	....	86	175	160	1,260	295	51	25
30	101	....	86	145	272	1,160	250	51	25
31	101	....	86	....	365	....	230	46	....

Monthly discharge of Little Wind River above Arapahoe, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	401	101	194	11,900
November 1-12	98	74	85.3	2,030
March 20-31	132	86	93.4	2,220
April	175	50	78.1	4,650
May	365	100	208	12,800
June	1,760	445	993	59,100
July	955	230	566	34,800
August	230	46	110	6,760
September	53	25	37.3	2,220

OWL CREEK NEAR THERMOPOLIS, WYO.

Location.—About sec. 16, T. 43 N., R. 95 W., at Whetstine's ranch, 6 miles northwest of Thermopolis, in Hot Springs County. No tributary between station and mouth.

Drainage area.—463 square miles (measured on base map of Wyoming, scale, 1:500,000).

Records available.—July 30, 1910, to October 31, 1912; April 1, 1915, to September 30, 1916. Station maintained by State engineer during 1913 and 1914.

Gage.—Slope gage installed October 13, 1915, at footbridge 50 feet downstream from chain gage used by State engineer, and referred to same datum; read by W. E. Whetstine. Owing to slope of creek, slope gage reads approximately 0.1 foot lower. Gage used from 1910 to 1912 was chain on upstream side of highway bridge one-quarter mile above present site. Relation between the gage readings not known.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Bed composed of compact gravel. Control 100 feet down stream from gage at small rapids; fairly permanent during 1916. Right bank no subject to overflow; left bank is overflowed at stage about 6.6 feet. Stage o zero flow 1.2 feet.

Extremes of discharge.—Maximum stage recorded during year, 3.79 feet at 12.3 p. m. June 18 (discharge, 184 second-feet); no flow, August 20 to September 16

Ice.—Stage-discharge relation seriously affected by ice; observations discontinue during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 12 second-feet from Owl Creek above station and 65 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve not wel defined. Gage read to tenths twice daily. Daily discharge ascertained by apply ing mean daily gage height to rating table. Records good except those for low water, which are roughly approximate.

Discharge measurements of Owl Creek near Thermopolis, Wyo., during the year endin Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	M. N. Grant, jr.	2.98	89	June 13	H. K. Smith	2.12	21.
May 4	R. H. Fletcher	2.21	22.8	July 26	...do	1.50	[a] .

[a] Estimated.

Daily discharge, in second-feet, of Owl Creek near Thermopolis, Wyo., for the year endin Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	Mar.	May.	June.	July.	Aug.	Sept.
1	96	59		40	73	20	27	0.6	0.
2	96	59		27	58	24	47	.6	.
3	96	59		19	50	33	36	.6	.
4	90	53		16	31	54	27	.6	.
5	90	53		16	58	58	24	.6	.
6	102	59		16	90	58	31	.6	.
7	96	59		24	78	47	32	.6	.
8	102	51		36	50	24	16	.6	.
9	90	51		27	24	58	16	.6	.
10	62	53		24	14	58	19	.6	.
11	62	51		27	14	47	10	.6	.
12	62	51		30	14	16	14	.6	.
13	78	51		33	19	19	10	.6	.
14	78	44		33	24	22	12	.6	.
15	68	50		36	36	27	10	.6	.
16	68	48		36	30	68	16	.6	.
17	68	51		30	43	96	12	.6	.
18	68	51		24	58	90	10	.6	.
19	68	51		24	73	78	6	.6	.
20	59	51		27	54	77	.6	.0	.
21	64	55		24	33	58	.6	.0	.
22	64	55		27	30	64	.6	.0	.
23	59	48		33	16	19	.6	.0	.
24	59	48		40	14	8	.6	.0	1.
25	59	44		50	10	16	.6	.0	1.
26	51	51	84	68	7	33	.6	.0	1.
27	51	51	90	84	7	78	.6	.0	1.
28	53	50	73	103	8	110	.6	.0	1.
29	59	50	64	96	14	110	.6	.0	1.
30	59	50	50	78	18	58	.6	.0	1.
31	59		47		19		.6	.0	

Note.—Discharge estimated Nov. 28-30. Water below gage July 20 to Aug. 19. and Sept. 17-30; dis charge estimated from discharge measurements of July 26 and Oct. 3.

Monthly discharge of Owl Creek near Thermopolis, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	102	51	72.1	4,430
November	59	44	51.9	3,090
March 26-31	90	47	68.0	809
April	103	16	38.1	2,270
May	90	7	34.4	2,120
June	110	8	50.9	3,030
July	47	.6	12.3	756
August	.6	.0	.37	22.8
September	1.0	.0	.37	22.0

NO WOOD CREEK AT BONANZA, WYO.

LOCATION.—In sec. 13, T. 49 N., R. 91 W., at Bonanza, in Big Horn County. Nearest tributary, Paintrock Creek, enters some distance above.

DRAINAGE AREA.—1,790 square miles (measured on base map of Wyoming, scale 1:500,000).

RECORDS AVAILABLE.—July 29, 1910, to October 31, 1912; April 1, 1915, to September 30, 1916.

GAGE.—Chain gage on left bank 1,000 feet below the store at Bonanza; read by Mrs. W. E. Taylor. Datum may be slightly different from that used, 1910 to 1912, as bench mark had been destroyed and there was no means of checking the old gage.

DISCHARGE MEASUREMENTS.—Made by wading or from two-span highway bridge one-fourth mile below gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 100 feet downstream from gage at small rapids, which shift slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.8 feet on June 6 (discharge, 2,140 second-feet); minimum stage, 2.16 feet September 6 and 7 (discharge, 67 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 80 second-feet for irrigation above station and 42 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent, except as affected by shifting control. Rating curve well defined between 100 and 3,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage height to rating table. Records good except those for October and November, which are fair.

Discharge measurements of No Wood Creek at Bonanza, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	M. N. Grant, jr.	3.01	314	July 24	H. K. Smith	2.82	245
May 2	R. H. Fletcher	3.64	659	Sept. 22	do	2.42	127
June 11	H. K. Smith	6.24	2,570				

Daily discharge, in second-feet, of No Wood Creek at Bonanza, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	440	420	212	725	1,310	1,520	212	88
2	400	382	212	610	1,310	1,100	180	88
3	440	382	212	667	1,170	1,100	180	88
4	400	382	212	610	1,450	905	150	88
5	400	420	212	845	1,980	845	150	88
6	348	382	246	785	2,140	725	150	67
7	348	460	246	1,590	1,450	785	150	67
8	348	420	246	1,520	1,380	845	144	112
9	315	382	212	1,310	1,450	845	144	107
10	348	460	212	1,380	1,170	725	144	107
11	348	460	212	1,100	2,500	667	117	107
12	348	420	246	965	1,740	502	117	107
13	382	382	246	785	1,820	452	117	107
14	502	382	212	725	1,980	405	117	107
15	382	382	212	667	2,140	405	117	107
16	348	382	282	555	1,900	502	93	107
17	348	382	361	555	1,820	502	93	84
18	315	382	452	502	2,680	452	93	107
19	315	382	452	502	3,780	405	93	107
20	348	382	502	452	2,680	361	93	120
21	315	382	405	845	2,230	361	93	120
22	315	382	361	905	2,590	320	93	120
23	315	382	361	845	1,450	282	117	122
24	315	382	405	785	1,310	246	112	110
25	315	382	405	785	1,450	190	112	97
26	315	382	725	845	1,520	180	88	97
27	285	382	1,240	725	1,660	180	112	110
28	285	382	905	785	1,740	150	139	110
29	285	382	725	1,380	1,660	150	139	97
30	255	382	405	1,520	1,660	452	112	97
31	382	....	....	1,820	....	320	112	....

NOTE.—Shifting-control method used Oct. 1 to Nov. 14. Discharge Nov. 15–30 and Apr. 1 estimated because of ice.

Monthly discharge of No Wood Creek at Bonanza, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	502	255	349	21,500
November	460	382	395	23,500
April	1,240	212	378	22,500
May	1,820	502	906	55,700
June	3,780	1,170	1,840	109,000
July	1,520	150	544	33,400
August	212	88	125	7,690
September	122	67	101	6,010

TENSLEEP CREEK NEAR TENSLEEP, WYO.

LOCATION.—In sec. 12, T. 47 N., R. 88 W., 800 feet east of county bridge at Burke's ranch, 5 miles above Tensleep, in Washakie County. Nearest tributary, Canyon Creek, enters one-fourth mile upstream.

DRAINAGE AREA.—228 square miles (measured on base map of Wyoming, scale, 1:500,000).

RECORDS AVAILABLE.—September 21, 1910, to December 31, 1912; April 19, 1915, to September 30, 1916.

GAGE.—Inclined staff on left bank, 800 feet above county bridge, opposite vertical rock cliff; read by Lynn Burke.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 100 feet below gage.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control is just below gage at rapids, which may shift. Right bank is vertical rock cliff; left bank subject to overflow at extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at 7 a. m. June 12 (discharge, 1,710 second-feet); minimum stage, 0.08 foot at 11 a. m. February 5 (discharge, 56 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice. Open-channel rating curve assumed applicable.

DIVERSIONS.—There is a diversion of approximately 8 second-feet for power above the station. Prior to December 31, 1916, there were adjudicated diversions of 35 second-feet for irrigation, all below the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice during year. Rating curve well defined below 900 second-feet. Gage read to hundredths once daily except in periods of high water, when it is read twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except those for winter period which are only fair, owing to possible effect of ice on stage-discharge relation.

Discharge measurements of Tensleep Creek near Tensleep, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	*M. N. Grant, jr.*	0.61	126	July 24	H. K. Smith	0.68	144
May 1	*R. H. Fletcher*	.52	124	Sept. 26	do	.18	63
June 11	*H. K. Smith*	2.94	886				

Daily discharge, in second-feet, of Tensleep Creek near Tensleep, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	174	110	74	65	59	59	65	130	830	602	168	80
2	166	108	76	68	59	71	62	139	495	566	158	79
3	174	115	78	71	59	62	62	160	602	495	148	79
4	166	113	83	71	59	59	63	198	676	495	139	78
5	170	108	79	69	57	65	62	252	1,070	495	168	75
6	162	108	76	65	58	63	64	460	602	327	158	74
7	139	105	74	65	58	64	63	752	676	426	148	75
8	148	102	74	66	59	71	64	443	714	530	148	74
9	139	103	71	65	60	263	65	602	870	639	139	74
10	139	100	65	69	58	258	65	495	1,230	566	139	79
11	132	100	71	76	60	252	68	376	830	530	130	75
12	137	97	76	71	64	71	69	343	791	495	130	74
13	134	99	78	65	65	65	70	252	1,030	343	130	74
14	132	97	76	68	65	71	71	187	830	266	122	76
15	128	99	74	70	68	70	71	168	870	238	122	74
16	137	96	69	74	71	68	71	134	950	238	113	74
17	137	97	65	71	71	65	74	156	1,230	252	113	73
18	141	96	68	64	69	63	80	183	1,190	238	105	70
19	132	93	71	65	68	65	83	200	1,430	225	105	70
20	128	89	71	66	68	64	78	296	1,190	225	97	69
21	134	93	76	62	68	65	71	478	1,070	200	105	66
22	125	91	79	59	69	66	70	566	910	189	91	66
23	143	84	82	62	65	69	68	392	791	158	94	62
24	139	82	84	63	65	65	68	281	714	148	87	66
25	132	76	82	60	63	64	118	281	639	158	89	71
26	134	69	73	62	60	65	162	281	566	178	97	74
27	143	65	69	59	64	64	212	252	752	148	91	74
28	125	69	68	62	55	63	312	409	791	139	86	79
29	116	71	65	63	57	62	189	530	870	148	84	73
30	111	71	70	56	......	63	148	676	752	281	82	70
31	116	------	68	58	......	63	......	791	......	189	82	......

NOTE.—Discharge June 5, 11–12 determined from hydrograph comparison with flow of Paintrock Creek and No Wood Creek, as gage readings are apparently 1.0 foot in error.

Monthly discharge of Tensleep Creek near Tensleep, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	174	111	140	8,610
November	115	65	93.5	5,560
December	84	65	73.7	4,530
January	76	56	65.5	4,030
February	71	55	62.8	3,610
March	263	59	83.8	5,150
April	312	62	92.9	5,530
May	791	130	350	21,500
June	1,430	495	865	51,500
July	639	139	327	20,100
August	168	82	118	7,260
September	80	62	73.2	4,360
The year	1,430	55	195	142,000

PAINTROCK CREEK NEAR BONANZA, WYO.

LOCATION.—About sec. 19, T. 49 N., R. 90 W., at Paumer's ranch, 1½ miles above Bonanza, in Big Horn County. No tributary between station and mouth, 1 mile below.

DRAINAGE AREA.—398 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—July 28, 1910, to October 31, 1912; April 19, 1915, to September 30, 1916.

GAGE.—Vertical staff on right bank 300 feet below ranch house; read by Mrs. Wm. Paumer. From July 28, 1910, to October 31, 1912, there was a chain gage near house. Relation between two gages not known; high water changed channel between.

DISCHARGE MEASUREMENTS.—Made from cable 65 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is at rapids composed of small boulders 150 feet below gage; somewhat shifting. Right bank is low and is overflowed at stage of 2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.75 feet at 8 a. m. June 19 (discharge, 2,670 second-feet) gage destroyed by high water during afternoon; minimum stage recorded, 1.0 foot August 22 (discharge, 9 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 66 second-feet from Paintrock Creek, practically all being above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Three fairly well defined rating curves used as follows: October 1 to November 24; March 12 to June 19; and July 2 to September 30. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except those for October, November, August, and September, which are fair.

Discharge measurements of Paintrock Creek near Bonanza, Wyo., during the year ending Sept. 10, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	M. N. Grant, jr.	1.52	114	July 24	H. K. Smith	1.57	89
May 2	R. H. Fletcher	1.51	100	Sept. 22	do	1.23	29.4
June 11	H. K. Smith	3.41	1,360				

ily discharge of Paintrock Creek near Bonanza, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	182	105	....	53	109	708	650	80	19
	182	105	....	58	99	332	636	71	14
	174	100	....	59	92	346	397	52	14
	167	100	....	58	102	746	342	40	14
	167	100	....	56	208	950	270	38	16
	167	100	....	55	246	532	230	38	19
	160	94	....	53	498	404	230	38	24
	157	94	....	56	204	346	426	35	24
	140	89	....	56	374	746	368	24	14
	140	89	....	58	466	1,040	316	24	14
	137	84	....	53	319	1,320	270	24	14
	131	84	106	55	228	825	212	24	14
	128	84	96	56	170	950	201	24	14
	122	84	77	56	140	865	198	19	14
	116	84	58	56	106	908	191	14	14
	110	80	53	56	96	950	234	14	18
	110	80	77	56	70	1,520	208	14	24
	110	80	86	59	63	1,620	194	12	24
	116	84	58	63	66	2,620	174	12	31
	122	84	64	63	114	1,500	128	12	31
	122	84	63	63	180	1,080	114	10	31
	128	84	59	64	160	1,370	102	9	28
	128	84	58	53	140	720	99	24	24
	128	87	56	73	114	430	87	24	24
	128	84	53	119	228	520	75	24	24
	128	84	56	122	188	600	77	24	28
	122	84	56	125	152	680	55	38	28
	116	84	56	137	184	770	63	38	30
	110	84	55	137	346	690	223	38	32
	105	84	53	119	785	690	177	31	38
	106	....	53	....	825	....	114	24	....

TE.—Discharge Nov. 25–30 estimated because of ice. Gage washed out during afternoon of June 19; arge, June 20 to July 1, estimated by comparison with records of flow of No Wood Creek at Bonanza

y discharge, in second-feet, of Paintrock Creek near Bonanza, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ober	182	105	134	8,240
ember	105	80	88.2	5,250
12-31	106	53	64.4	2,550
	137	53	71.4	4,250
	825	62	228	14,000
ne	2,620	332	893	53,100
	650	55	228	14,000
	80	9	28.8	1,770
ptember	38	14	21.9	1,300

GREYBULL RIVER NEAR MEETEETSE, WYO.

ATION.—In sec. 13, T. 48 N., R. 101 W., at private bridge at Wilson's ranch, 4½ miles southwest of Meeteetse, in Park County. Rawhide Creek enters 1½ miles above and Iron Creek 1½ miles below.

AINAGE AREA.—680 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—September 14, 1910, to October 31, 1912; June 6, 1915, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by Mrs. Katherine Wilson. Gage used from 1910 to 1912 was on center pier and was referred to datum 0.72 foot lower than that of present gage.

Discharge measurements.—Made from two-span bridge or by wading.

Channel and control.—Bed composed of coarse gravel and small boulders. Control is 50 feet downstream from gage at site of an old bridge; badly shifting during 1916. Banks subject to overflow at stage of about 5 feet.

Extremes of discharge.—Maximum stage not known; record incomplete. Minimum stage recorded, 0.6 foot on April 4 (discharge, 80 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 86 second-feet from Greybull River above station and 648 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve not well defined, shifting control method used after May 20. Gage read to half tenths once daily. Daily discharge ascertained by applying gage height to rating table. Records fair except those for last part of year which are roughly approximate.

Discharge measurements of Greybull River near Meeteetse, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	M. N. Grant, jr.	1.44	277	June 9	H. K. Smith	2.66	1,250
Apr. 26	R. H. Fletcher	1.50	334	July 21	....do	1.66	643
27	....do	1.86	483	Sept. 17	....do	.86	158

Daily discharge, in second-feet, of Greybull River near Meeteetse, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	455	202	....	115	253	....	....	548	....
2	455	202	....	105	253	....	....	548	....
3	485	202	....	88	237	688	....	517	....
4	455	202	....	80	390	1,340	....	548	....
5	428	202	....	88	462	....	....	615	....
6	375	194	....	95	490	....	....	517	....
7	350	185	....	95	688	....	....	615	....
8	375	185	....	105	462	....	....	580	....
9	400	168	....	115	462	1,250	....	490	....
10	400	....	....	150	437	....	....	490	....
11	350	....	....	237	346	....	....	490	....
12	328	....	....	206	307	....	....	517	....
13	328	....	....	150	288	....	....	490	....
14	328	....	....	206	221	....	....	462	....
15	305	....	....	270	237	....	....	462	....
16	305	....	....	221	237	....	....	462	....
17	305	....	....	191	253	....	....	462	158
18	282	....	....	206	270	....	....	462	156
19	282	....	....	191	326	....	....	390	156
20	282	....	....	138	....	....	....	462	156
21	282	....	138	138	....	....	658	462	156
22	260	....	126	150	762	....	....	462	156
23	260	....	115	150	615	....	548	437	156
24	240	....	126	191	615	....	548	437	156
25	220	....	163	253	412	....	548	462	156
26	240	....	115	326	462	....	580	462	156
27	240	....	115	412	490	....	548	437	183
28	220	....	115	517	517	....	885	437	169
29	220	....	115	326	....	....	688	437	169
30	220	....	105	326	....	....	615	437	156
31	202	....	95	....	....	....	548	437	....

Note.—Discharge Nov. 6, Aug. 18 and 31, estimated. Shifting-control method used after May 20.

Monthly discharge of Greybull River near Meeteetse, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	485	202	319	19,600
November 1-9	202	168	194	3,460
March 21-31	163	95	121	2,640
April	517	80	195	11,600
August	615	390	485	29,800
September 17-30	183	156	160	4,440

WOOD RIVER NEAR MEETEETSE, WYO.

Location.—Near line between secs. 22 and 27, T. 48 N., R. 101 W., 1,200 feet above mouth of Wood River and 7 miles southwest of Meeteetse, in Park County.

Drainage area.—218 square miles (measured on base map of Wyoming, scale, 1:500,000).

Records available.—September 15, 1910, to October 31, 1912; May 10, 1915, to September 30, 1916.

Gage.—Chain gage on left bank, 400 feet above bridge, used since April 25, 1916; read by Mrs. Adah River. Original gage, used during 1910–1912, was vertical staff at bridge. Gage used from May 10, 1915, to April 24, 1916, was vertical staff at bridge but was referred to datum different from that of original gage.

Discharge measurements.—Made from cable short distance below gage.

Channel and control.—Bed composed of boulders. Control at small rapids a short distance below gage; practically permanent during 1916. Right bank subject to overflow at extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 3.85 feet at 5 p. m. June 18 (discharge, 888 second-feet); minimum stage recorded, 1.02 feet, March 24, 1916 (discharge, 43 second-feet); lower discharge probably occurred during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 66 second-feet from Wood River, and 9 second-feet from tributaries.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 80 and 500 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage height to rating table. Records good except those for low water, which are fair.

Discharge measurements of Wood River near Meeteetse, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	M. N. Grant, jr.	1.60	135	June 9	H. K. Smith	2.81	452
Apr. 25	R. H. Fletcher	[a] 1.97	104	July 21	.....do	2.25	219
27	.....do	2.12	165	Sept. 17	.....do	1.80	82

[a] Old gage read 1.41 feet.

Daily discharge, in second-feet, of Wood River near Meeteetse, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	218	106	....	56	107	321	321	175	84
2	218	97	....	49	107	300	321	167	84
3	197	106	....	49	107	279	300	155	84
4	197	106	....	49	115	321	237	167	84
5	186	106	....	56	163	384	258	175	84
6	176	106	....	56	216	300	271	216	84
7	166	115	....	49	245	258	279	167	84
8	176	89	....	70	195	363	321	155	74
9	176	89	....	56	195	531	321	144	74
10	156	89	....	77	195	426	279	155	74
11	166	89	....	92	155	405	237	138	66
12	156	97	101	77	155	363	229	130	69
13	156	89	110	77	138	447	229	120	69
14	146	97	84	84	120	405	203	112	66
15	146	97	119	101	138	447	203	107	66
16	135	97	101	84	127	531	195	107	66
17	135	97	92	84	127	573	195	102	66
18	135	97	70	77	138	867	203	88	66
19	135	97	63	84	195	699	175	94	66
20	135	89	63	84	405	531	163	107	66
21	135	89	56	77	363	615	183	94	74
22	135	81	56	70	363	363	175	88	66
23	135	89	49	70	300	321	175	84	66
24	115	89	43	77	279	300	175	84	66
25	115	89	63	92	279	321	138	80	66
26	125	81	63	120	279	405	144	84	66
27	115	81	63	155	279	489	195	94	66
28	125	97	56	195	279	573	216	94	74
29	115	81	49	138	279	468	237	94	74
30	115	81	56	115	405	321	195	84	74
31	115	....	70	....	384	....	175	88	....

Monthly discharge of Wood River near Meeteetse, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	218	115	150	9,220
November	115	81	93.8	5,580
March 12-31	119	43	71.4	2,830
April	195	49	84.0	5,000
May	405	107	220	13,500
June	867	258	431	25,600
July	321	138	224	13,800
August	216	80	121	7,440
September	84	66	72.3	4,300

SHELL CREEK AT SHELL, WYO.

Location.—About sec. 26, T. 53 N., R. 91 W., 450 feet above headgate of Shell canal, three-fourths mile northeast of Shell, in Big Horn County. Nearest tributary, Trapper Creek, enters some distance above.

Drainage area.—256 square miles (measured on base map of Wyoming, scale, 1:500,000).

Records available.—April 1, 1915, to September 30, 1916. From July 1, 1911, to October 31, 1914, station was maintained by the Wyoming Irrigation Co. and records were published in reports of State engineer.

Gage.—Vertical staff on right bank 450 feet above canal headgate; read by J. G. Tatlock.

Discharge measurements.—Made from suspension footbridge at gage.

ANNEL AND CONTROL.—Bed composed of gravel. Control is just below gage at gravel bar which shifts during high water. Banks not subject to overflow.

XTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.5 feet at 5 a. m. June 10 (discharge, 1,360 second-feet); minimum stage recorded, 3.9 feet, November 20 and 28–30 (discharge, 58 second-feet); a less discharge probably occurred during winter months.

—No information; observations are discontinued during winter months.

ERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 8 second-feet from Shell Creek above the station and 104 second-feet below.

REGULATION.—Flow controlled to a certain extent by storage of water in Adelaide reservoir on Shell Creek, 25 miles above Shell. Capacity of reservoir, 1,410 acre-feet.

RACY.—Stage-discharge relation not permanent. Gage read to hundredths twice daily. Daily discharge ascertained by shifting-control method. Records fair.

PERATION.—Gage-height records furnished by Wyoming Irrigation Co.

harge measurements of Shell Creek at Shell, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
19	M. N. Grant, jr.	4.10	75	June 10	H. K. Smith	7.20	1,200
2[illegible]	R. H. Fletcher	4.33	145	Sept. 21	do	4.20	77

discharge, in second-feet, of Shell Creek at Shell, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
	102	72	83	108	490	350	89	78
	102	72	83	102	335	350	102	78
	95	72	83	95	191	320	102	72
	102	72	83	102	350	306	102	72
	95	72	83	162	802	277	102	67
	89	72	83	350	434	263	102	62
	89	69	83	306	320	237	102	62
	83	69	83	225	434	335	102	62
	82	69	83	320	900	250	102	62
	82	68	83	335	1,300	237	102	72
	82	68	83	225	900	202	89	72
	83	67	89	202	572	191	89	72
	82	67	83	191	754	181	83	72
	81	67	83	137	900	181	83	72
	76	67	95	137	900	171	83	72
	78	67	95	130	900	181	83	67
	78	67	89	130	754	171	83	67
	78	64	95	122	950	162	83	67
	78	61	89	145	1,000	153	83	67
	78	58	83	202	802	145	89	66
	78	59	83	225	551	130	83	64
	77	65	89	225	730	130	83	62
	76	67	83	213	594	122	83	62
	78	67	89	202	551	122	83	67
	74	67	102	202	490	145	83	67
	73	62	108	181	551	130	83	62
	72	62	115	171	510	115	89	62
	73	58	145	181	510	108	83	62
	72	58	122	277	471	122	83	62
	72	58	108	434	416	130	83	62
	72	....	....	684	....	102	83	....

NOTE.—Discharge interpolated Oct. 5, 9, 10, 13, 17, 18, 22, 25, 26, Nov. 4, 5, 10–12, 18, 19, 24, Sept. 20 and 21.

Monthly discharge of Shell Creek at Shell, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	102	72	81.7	5,020
November	72	58	66.1	3,930
April	145	83	91.9	5,470
May	684	95	217	13,300
June	1,300	191	645	38,400
July	350	102	194	11,900
August	102	83	89.5	5,500
September	78	62	67.1	3,990

SHOSHONE RIVER NEAR ISHAWOOA, WYO.

Location.—On line between secs. 26 and 27, T. 51 N., R. 104 W., at Coe's private bridge, 1½ miles northeast of Ishawooa, in Park County. Nearest tributary, Belknap Creek, enters at Ishawooa.

Drainage area.—532 square miles (measured on base map of Wyoming, scale 1:500,000).

Records available.—May 23, 1915, to September 30, 1916.

Gage.—Vertical staff on first right downstream piling of bridge; read by Miss Ina Spaulding.

Discharge measurements.—Made from five-span pile bent bridge or by wading.

Channel and control.—Bed composed of boulders. Control not well defined; shifts during high water. Right bank not subject to overflow; left bank subject to overflow at high stages.

Extremes of discharge.—Maximum stage recorded during year, 5.9 feet at 5.30 p. m. June 18 (discharge, 4,760 second-feet); minimum stage recorded, 0.72 foot, November 13 and April 1 (discharge, 170 second-feet); a less discharge probably occurred during winter months.

Ice.—No information; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were approved diversions of 26 second-feet from Shoshone River above station and 40 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve used from October 1 to September 17 fairly well defined between 140 and 1,700 second-feet; but poorly defined above 1,700 second-feet. Curve used September 18–30 fairly well defined between 140 and 700 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating tables; shifting- control method used July 22 to September 17. Records fair.

Discharge measurements of Shoshone River near Ishawooa, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	M. N. Grant, jr	1.26	300	July 19	H. K. Smith	3.48	1,690
Apr. 23	R. H. Fletcher	1.06	253	Sept. 18	do	1.50	237
June 8	H. K. Smith	3.12	1,370				

Daily discharge, in second-feet, of Shoshone River near Ishawooa, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	601	251	....	170	292	825	3,500	1,530	380
	623	251	....	196	485	765	4,060	1,450	377
	601	251	....	201	440	858	4,200	1,080	373
	467	251	....	196	579	1,300	2,840	1,010	350
	449	251	....	215	851	1,370	3,230	1,590	329
	424	251	....	201	1,160	1,020	3,360	1,130	325
	377	257	....	201	1,200	1,080	3,360	1,120	308
	377	201	....	205	890	1,530	3,640	1,050	289
	384	201	....	201	929	1,910	3,640	1,050	286
	384	192	....	225	825	2,020	2,970	974	283
	400	192	....	286	729	1,810	2,840	903	265
	361	187	....	274	741	2,020	2,970	832	262
	361	170	....	262	568	2,240	2,720	825	262
	339	....	....	645	495	2,130	2,360	765	259
	347	....	....	312	476	2,970	2,020	729	243
	325	....	....	325	416	3,640	2,020	693	240
	354	....	....	305	408	4,340	2,450	628	238
	347	....	....	292	424	4,760	2,130	623	235
	312	....	235	286	495	4,340	1,710	562	235
	305	....	225	262	825	3,640	1,810	562	235
	305	....	215	251	765	3,360	1,810	505	235
	305	....	201	268	729	3,360	1,700	500	232
	299	....	210	261	568	1,810	1,510	449	232
	318	....	187	292	838	1,810	1,510	467	221
	280	....	192	416	623	2,360	1,420	462	214
	280	....	179	634	699	3,360	1,660	462	207
	274	....	183	825	535	4,480	1,410	436	235
	274	....	192	890	568	4,620	1,570	412	207
	262	....	187	612	729	4,340	1,940	408	207
	262	....	187	485	955	3,500	2,040	404	207
	257	....	179	....	1,050	....	1,300	380	....

Monthly discharge of Shoshone River near Ishawooa, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ober	623	257	363	22,300
vember 1–13	257	170	224	5,780
March 19–31	235	179	198	5,100
ril	890	170	339	20,200
May	1,200	292	687	42,200
June	4,760	765	2,590	154,000
y	4,200	1,300	2,440	150,000
gust	1,590	380	774	47,600
September	380	207	266	15,800

SHOSHONE RIVER AT CORBETT DAM, WYO.

Location.—In NE. ¼ sec. 7, T. 53 N., R. 100 W., at Corbett diversion dam, 8 miles below Cody, in Big Horn County.

Drainage area.—Not measured at this station; drainage area above Cody is 1,400 square miles. Sage Creek, the only important tributary that enters between this station and Cody, drains about 25 square miles.

Records available.—April 20, 1908, to September 30, 1916.

Gage.—Staff gage 40 feet upstream from the crest of the dam; readings represent height of water above crest. It is read once a day during the irrigation season and at irregular intervals during the winter by employees of the United States Reclamation Service.

Determination of discharge.—Discharge computed by considering the dam as a weir and the sluice gates as submerged orifices. The following formula for discharge over the crest was developed from measurements at Cody, Wyo.: $Q=3.50\ BH^{1.58}$.

Channel and control.—The crest of the dam forms a permanent control. The dam is of reinforced concrete of the buttressed type, having on the upstream side a deck 2½ feet thick, sloping 1 to 1, and supported by buttresses 2 feet thick spaced 14 feet on centers; it raises the low-water elevation of the river 10.2 feet; length between abutments, 400 feet.

Extremes of discharge.—Maximum stage recorded during year, 3.40 feet June 20 (discharge, 9,700 second-feet; discharge through Corbett tunnel, 533 second-feet; total, 10,200 second-feet); minimum stage recorded, 0.35 foot May 7 (discharge, 270 second-feet; discharge through Corbett tunnel, 255 second-feet; total, 525 second-feet).

1908–1916: Maximum stage recorded, 4.79 feet, July 4, 1909 (discharge, 15,400 second-feet); no flow October 21 to November 19, 1909.

Ice.—Stage-discharge relation not seriously affected by ice; open-channel rating curve assumed applicable. Records not complete enough for computing discharge.

Diversions.—Little water is diverted above this station.

Regulation.—Shoshone reservoir, with a capacity of 456,000 acre-feet regulates the flow.

Accuracy.—Stage-discharge relation practically permanent; rating curve fairly well defined; gage read to hundredths once daily; daily discharge ascertained by applying gage height to rating table and adding the daily flow through tunnels. Records good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Shoshone River, including tunnels, at Corbett dam, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	808	717	......	......	......	......	......	677	2,410	9,450	2,830	862
2	810	877	......	......	......	......	......	660	2,210	9,470	2,660	812
3	812	710	......	......	......	......	......	683	2,030	9,370	2,510	811
4	814	710	......	......	......	......	......	661	2,230	8,750	2,370	915
5	816	723	......	......	......	......	......	573	2,790	7,770	2,200	1,610
6	818	681	......	......	......	......	......	553	3,070	7,810	2,640	1,570
7	818	622	......	......	......	......	......	525	2,950	7,530	2,510	1,110
8	807	632	......	......	......	......	......	638	2,830	7,680	2,220	1,130
9	796	692	......	......	......	......	......	727	3,490	7,680	2,410	1,050
10	785	788	......	......	......	......	676	949	4,320	8,040	2,210	1,040
11	774	717	......	......	......	......	657	1,440	4,650	7,900	2,070	1,060
12	763	1,400	......	......	......	......	657	1,490	4,650	6,960	1,910	1,130
13	752	......	......	......	......	......	657	1,460	4,760	6,610	1,870	1,220
14	741	......	......	......	......	......	644	1,660	5,200	6,650	1,760	1,070
15	730	......	......	......	......	......	657	1,480	5,660	5,900	1,740	1,080
16	719	......	......	......	......	......	657	1,340	6,580	5,390	1,520	1,220
17	708	......	......	......	......	......	632	1,320	8,170	5,190	1,480	747
18	697	......	......	......	......	......	632	1,280	9,200	5,230	1,390	816
19	686	......	......	......	......	......	632	1,170	10,100	4,810	1,280	816
20	675	......	......	......	......	......	590	1,350	10,200	4,320	1,200	899
21	664	......	......	......	......	......	572	1,840	9,850	4,010	1,210	682
22	653	......	647	......	......	......	690	1,920	8,360	3,770	1,220	865
23	642	......	......	......	......	664	670	1,950	6,660	3,540	1,000	662
24	631	......	......	630	......	......	643	1,880	5,430	3,420	880	585
25	620	......	......	......	......	......	643	1,950	5,410	3,320	1,020	610
26	609	......	......	......	647	......	709	1,920	5,380	3,140	919	635
27	657	......	......	......	......	......	687	1,770	5,840	3,150	861	661
28	749	......	......	......	......	......	645	1,790	8,380	3,140	878	687
29	707	836	......	......	......	......	638	1,780	10,100	3,250	967	713
30	717	836	......	......	......	......	624	1,780	9,800	3,190	804	739
31	717	......	......	......	......	......	......	2,090	......	3,520	869	......

Note.—Discharge, Oct. 1–6, 8–27, Aug. 19, and Sept. 24–29, interpolated. Discharge estimated by U. S. Reclamation Service engineers as follows: Nov. 13–28, 900 second-feet; Dec. 1–21, 740 second-feet; and Dec. 23–31, 650 second-feet.

*Monthly **discharge** of **Shoshone River**, including tunnels at Corbett dam, Wyo., for the year ending Sept. 30, 1916.*

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	818	609	732	45,000
November	1,400	622	845	50,300
December	....	....	[a] 711	43,700
April 10-30	709	572	648	27,000
May	2,090	525	1,330	81,800
June	10,200	2,030	5,760	343,000
July	9,570	3,140	5,810	357,000
August	2,830	804	1,660	102,000
September	1,610	585	927	55,200

[a] See footnote to daily-discharge table.

*Daily **discharge**, in second-feet, of Corbett tunnel at Corbett dam, Wyo., for the year ending Sept. 30, 1916.*

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	119	....	221	277	328	574	328
2	....	278	....	246	277	346	525	342
3	....	310	....	283	246	321	508	341
4	....	310	....	303	246	277	487	317
5	....	323	....	303	318	323	437	323
6	....	323	....	283	351	489	378	323
7	....	264	....	255	433	534	378	323
8	....	190	....	332	393	562	259	365
9	....	190	....	421	426	562	328	336
10	....	190	46	351	474	630	327	279
11	....	119	107	381	474	700	308	224
12	....	41	107	349	474	631	266	224
13	....	....	107	283	576	700	277	276
14	....	....	94	303	576	702	288	252
15	....	....	107	303	623	677	342	189
16	....	....	107	259	626	692	343	197
17	....	....	130	265	636	672	342	197
18	....	....	130	302	600	710	373	218
19	....	....	130	302	439	632	328	218
20	....	....	88	268	533	660	305	301
21	....	....	70	197	600	660	316	364
22	....	....	124	215	413	660	420	363
23	....	....	152	241	328	605	450	160
24	....	....	173	241	284	620	378	58
25	....	....	173	241	261	657	418	58
26	....	....	191	210	226	625	417	58
27	59	....	217	176	0	626	359	58
28	119	....	217	197	0	625	328	58
29	109	....	210	259	107	594	369	58
30	119	....	196	258	324	526	334	58
31	119	....	....	259	....	524	335	....

NOTE.—Discharge record showing acre-feet per day furnished by United States Reclamation Service; converted into second-feet by engineers of United States Geological Survey.

*Monthly **discharge** of Corbett tunnel at Corbett dam, Wyo., for the year ending Sept. 30, 1916.*

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 27-31	119	59	105	1,040
November 1-12	323	41	221	5,260
April 10-30	217	46	137	5,710
May	421	176	274	16,800
June	636	0	385	22,900
July	710	277	576	35,400
August	574	259	371	22,800
September	365	58	229	13,600

SOAP CREEK NEAR ST. XAVIER, MONT.

Location.—In sec. 20, T. 5 S., R. 32 E., at Henry Reed's ranch, about a mile above mouth of stream, 9 miles south of St. Xavier, in Big Horn County.

Drainage area.—Not measured.

Records available.—September 11, 1911, to September 30, 1916. April 25, 1914, to June 12, 1915, at Frank Annerer's ranch about half a mile above present site; September 11, 1911, to November 30, 1913, in W. ½ NW. ¼ sec. 2, T. 6 S., R. 32 E., about one-fourth mile above headworks of Soap Creek ditch.

Gage.—Overhanging chain gage on right bank opposite Henry Reed's house; read by Henry Reed. Original gage, in use September 11, 1911, to November 30, 1913, was overhanging chain gage about one-fourth mile above headworks of Soap Creek ditch; gage used April 25, 1914, to June 12, 1915, a chain gage on footbridge near Frank Annerer's house, about one-fourth mile above present site. After July 8, 1915, present gage was used.

Discharge measurements.—Made by wading or from highway bridge about 1 mile upstream from gage.

Channel and control.—Bed of stream at principal control composed of gravel and silt; shifts slightly. Stage-discharge relation affected at times by growth of aquatic plants in channel.

Extremes of discharge.—Maximum stage recorded during year, 7.27 feet at 7.30 a. m. May 15 (discharge, 252 second-feet); minimum stage recorded, 2.86 feet October 25 (discharge, 13 second-feet).

1911–1916: Maximum stage recorded, 12.8 feet May 11, 1914, determined by leveling from flood marks (discharge, determined from extension of rating curve, about 438 second-feet); minimum stage recorded, 2.1 feet September 10, 1914 (discharge, 1 second-foot).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Soap Creek ditch diverts above station during summer for irrigation.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by shifting control and growth of aquatic plants in channel. Rating curves used as follows: October 1 to November 10 poorly defined; March 25 to June 1 well defined below 63 second-feet; August 8 to September 30 poorly defined. Gage read twice daily to hundredths. Discharge ascertained by applying mean daily gage height to rating table, except June 2 to August 7, for which shifting-control method was used. Records subject to considerable error.

Discharge measurements of Soap Creek near St. Xavier, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 1	3.50	41.0
Aug. 6	2.98	17.5

Daily discharge, in second-feet, of Soap Creek near St. Xavier, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	16	14		34	46	40	16	18	17
2	16	13		103	30	36	16	18	16
3	14	13		151	30	32	16	18	17
4	26	14		169	28	32	16	18	16
5	23	14		73	28	31	16	18	16
6	17	14		44	26	31	16	18	17
7	15	15		56	26	29	17	18	16
8	15	15		46	25	28	17	18	17
9	15	15		40	38	28	17	18	17
10	16	16		34	30	28	17	18	17
11	17			36	36	27	17	18	22
12	16			36	26	27	17	17	22
13	14			30	30	27	17	17	20
14	13			40	83	26	16	17	21
15	16			26	187	25	17	17	21
16	16			24	109	24	17	16	21
17	15			25	44	23	17	16	21
18	14			40	40	21	17	16	21
19	14			26	44	17	17	16	21
20	14			28	44	16	17	16	21
21	14			40	46	18	17	16	21
22	14			30	78	20	17	16	21
23	14			42	133	18	19	16	21
24	13			26	83	16	18	16	21
25	13		24	30	63	18	18	16	21
26	14		44	24	53	17	18	16	21
27	14		44	22	44	17	18	16	21
28	14		32	22	44	16	18	17	21
29	14		34	30	38	17	18	17	21
30	14		44	25	42	17	21	17	21
31	14		48		40		20	17	

Monthly discharge of Soap Creek near St. Xavier, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	26	13	15.3	941
November 1-10	16	13	14.3	284
March 25-31	48	24	38.6	536
April	169	22	45.1	2,680
May	187	25	52.1	3,200
June	40	16	24.1	1,430
July	21	16	17.3	1,060
August	18	16	17.0	1,050
September	22	16	19.6	1,170

ROTTENGRASS CREEK NEAR ST. XAVIER, MONT.

Location.—In NW. ¼ sec. 6, T. 5 S., R. 23 E., about one-fourth mile above crossing of Big Horn canal, on Crow Indian Reservation, 4 miles south of St. Xavier, in Big Horn County.

Drainage area.—Not measured.

Records available.—September 9, 1911, to September 30, 1916.

Gage.—Overhanging chain on left bank about one-fourth mile above crossing of Big Horn canal; read by Loren S. Stanley.

Discharge measurements.—Made from footbridge about 500 feet above gage or by wading.

Channel and control.—Bed of stream gravel and silt; shifts. Banks above and below gage high and steep; not subject to overflow below gage height 11 feet (discharge about 400 second-feet).

Extremes of discharge.—Maximum stage during year, determined by leveling from flood marks, 5.8 feet at 10 a. m., May 15 (discharge, 78 second-feet); minimum stage recorded, 2.8 feet at 4 p. m., August 14 (discharge, 2.5 second-feet).

1911–1916: Maximum stage recorded, 11.3 feet June 12, 1915; (discharge, 420 second-feet); minimum stage recorded, 2.3 feet, September 27, 1911 (discharge, 0.3 second-foot).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve used October 1 to November 27 fairly well defined; curve used June 2 to September 30 well defined below 100 second-feet. Gage read to tenths (occasionally to half tenths) once daily to June 1 and twice daily thereafter. Discharge ascertained by applying mean daily gage height to rating table; shifting-control method used March 25 to June 1. Records fair.

Discharge measurements of Rottengrass Creek near St. Xavier, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-feet.*
Mar. 25	3.56	12.4
June 1	5.14	53.8
Aug. 6	2.98	3.8

Daily discharge, in second-feet, of Rottengrass Creek near St. Xavier, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	9	....	68	23	55	6.0	5.0	6.0
2	10	10	....	68	23	55	6.0	5.0	6.0
3	10	9	....	68	23	55	6.0	5.0	6.3
4	10	9	....	61	23	50	6.0	5.5	6.0
5	10	10	....	56	22	50	6.0	5.0	5.5
6	10	9	....	47	22	46	6.0	4.0	6.0
7	10	9	....	40	22	46	6.0	4.0	5.0
8	10	10	....	21	25	42	6.0	4.5	5.0
9	10	10	....	66	28	34	6.0	5.0	6.0
10	10	10	....	75	31	30	7.5	5.0	5.5
11	10	10	....	65	31	28	19.0	5.0	5.0
12	10	10	....	54	28	26	13.0	4.0	6.5
13	10	10	....	38	28	26	7.0	3.6	7.0
14	9	10	....	25	28	11	7.0	2.6	7.0
15	10	9	....	18	58	11	7.0	3.2	7.0
16	10	9	....	18	78	11	7.0	4.2	7.0
17	10	10	....	18	68	11	7.0	5.5	7.0
18	10	10	....	20	53	11	6.0	6.0	7.0
19	10	10	....	18	30	11	5.0	6.2	7.0
20	11	10	....	20	30	9.5	5.0	6.0	7.5
21	10	10	....	20	52	9	5.0	6.0	7.0
22	9	10	....	20	52	9	5.0	6.3	7.0
23	10	10	....	20	52	9	5.5	7.0	7.0
24	10	10	....	22	56	9	6.0	7.0	7.5
25	10	10	12	24	56	9	6.0	8.0	7.5
26	10	9	14	24	56	9	6.0	8.0	7.0
27	10	10	14	24	55	9	6.0	7.5	8.0
28	9	....	21	24	55	9	7.0	7.5	7.0
29	9	....	27	24	55	9	7.0	7.5	7.0
30	9	....	37	24	55	9	6.0	8.0	7.0
31	9	....	58	....	55	....	5.0	7.5	....

Note.—Gage not read Nov. 28 to Mar. 24.

Monthly discharge of Rottengrass Creek near St. Xavier, Mont., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	11	9	9.8	603
November 1-27	10	9	9.7	519
March 25-31	58	12	26.1	362
April	75	18	36.3	2,160
May	78	22	41.1	2,530
June	55	9	23.6	1,400
July	19	5.0	6.74	414
August	8.0	2.6	5.63	346
September	8.0	5.0	6.58	392

LITTLE HORN RIVER NEAR WYOLA, MONT.

LOCATION.—In W. ½ SW. ¼ sec. 28, T. 8 S., R. 35 E., one-fourth mile below proposed headworks of Little Horn canal No. 3 and about 16 miles above Lodgegrass Creek, 4 miles southwest of Wyola, in Big Horn County.

DRAINAGE AREA.—260 square miles.

RECORDS AVAILABLE.—September 7, 1911, to September 30, 1916.

GAGE.—Overhanging chain gage on right bank; read by C. C. Dillon to December 25, and by Ida M. Shipman after March 27, 1916.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet below gage or by wading near cable.

CHANNEL AND CONTROL.—Stream bed composed of boulders and gravel; shifts occasionally during high stage. Left bank high and not subject to overflow; right bank high but subject to overflow about 100 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet at 4 p. m. June 18 (discharge, 950 second-feet); minimum stage, 4.25 feet, 5.30 p. m. March 31 (discharge, 91 second-feet).

1912–1916: Maximum stage recorded, 6.6 feet June 11, 1915 (discharge, 1,130 second-feet); minimum stage, 4.2 feet April 10 and 12, 1915 (discharge, 32 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter. No notes on ice during November and December; records slightly affected, if at all.

DIVERSIONS.—Small amount diverted for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent, affected by slight shifts of control at high stages. Rating curve well defined below 500 second-feet. Gage read twice daily to hundredths. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Little Horn River near Wyola, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 27	4.30	102
June 2	5.23	391
Sept. 2	4.40	122

Daily discharge, in second-feet, of Little Horn River near Wyola, Mont., for the yea ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	110	104	....	100	154	396	442	156	12
2	124	110	104	....	108	154	396	418	152	12
3	126	110	104	....	100	142	396	418	147	12
4	127	108	104	....	96	156	418	373	142	12
5	127	108	104	....	100	166	516	331	138	11
6	124	108	104	....	100	223	418	331	142	12
7	120	109	104	....	98	274	418	292	142	12
8	120	110	104	....	96	274	568	292	142	11
9	120	110	104	....	104	292	675	292	131	11
10	122	112	110	....	100	292	675	274	144	13
11	124	112	110	....	100	274	594	256	142	13
12	124	110	107	....	102	256	466	256	142	13
13	120	110	104	....	100	256	491	223	142	13
14	120	111	104	....	100	240	594	223	142	12
15	120	112	102	....	110	193	621	223	142	12
16	120	112	102	....	120	193	675	193	131	12
17	120	114	100	....	116	193	675	193	120	12
18	120	116	100	....	116	208	895	180	100	12
19	120	116	102	....	120	223	895	180	142	11
20	120	116	104	....	120	256	785	180	131	11
21	120	116	106	....	120	274	675	180	135	11
22	120	116	110	....	120	292	675	180	124	11
23	120	114	112	....	124	331	621	166	124	11
24	120	112	112	....	120	312	568	166	120	11
25	120	110	110	....	124	292	516	166	120	11
26	104	110	....	....	131	292	466	166	131	12
27	104	110	....	100	138	292	516	166	131	12
28	104	110	....	98	142	292	466	166	112	12
29	108	110	....	100	161	396	442	166	116	12
30	110	110	....	98	154	396	418	166	120	12
31	110	....	....	93	....	491	....	166	120	....

NOTE.—Gage not read discharge interpolated for following days: Oct. 3, 10, 17, 24, 31, Nov. 7, 14, 21, 28, Dec. 5, 12, 19, and Apr. 15.

Monthly discharge of Little Horn River near Wyola, Mont., for the year ending ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	127	104	119	7,32
November	116	108	111	6,60
December 1-25	112	100	105	5,21
March 27-31	100	93	97.8	97
April	161	96	115	6,84
May	491	142	261	16,00
June	895	396	564	33,60
July	442	166	239	14,70
August	156	100	133	8,19
September	138	110	120	7,14

LITTLE HORN RIVER NEAR CROW AGENCY, MONT.

LOCATION.—In W. ½ sec. 18, T. 3 S., R. 35 E., at Chicago, Burlington & Quincy Railroad bridge 2 miles south of Crow Agency, in Big Horn County, 14 miles above junction with Big Horn River.

DRAINAGE AREA.—1,190 square miles.

RECORDS AVAILABLE.—September 7, 1911, to September 30, 1916; March 24, 1905, to June 30, 1906, for station at Crow Agency, about 2 miles below the present station; Crow Agency ditch diverts water between the stations.

GAGE.—Chain gage on downstream side of railway bridge; read by Everett Keeler. Records for 1911 were obtained from staff on bridge pier near left bank; gages at same datum. Records 1905–6, obtained from chain gage on upstream side of railroad bridge at Crow Agency.

HARGE MEASUREMENTS.—Made from upstream side of highway bridge, about 300 feet below gage or by wading.

ANNEL AND CONTROL.—Bed of stream composed of gravel; slightly shifting. Banks high; not subject to overflow below gage height about 14 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.65 feet at 6.30 p. m. June 20 (discharge, 1,360 second-feet); minimum stage, 4.30 feet August 24-31 and September 2-9 (discharge, 104 second-feet).

1905-6 and 1912-1916: Maximum stage recorded, 11.0 feet June 14, 1915 estimated discharge, 3,600 second-feet); minimum stage, 1.8 feet September 25-29, 1905 (discharge, 60 second-feet).

E.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

ERSION.—Several small diversions for irrigation from main stream and tributaries above station.

ULATION.—None.

CURACY.—Stage-discharge relation changed during winter period. Rating curve used before the change well defined between 84 and 1,050 second-feet; curve used after the change well defined between 100 and 1,000 second-feet. Gage read once daily to half tenths. Observer's readings in error occasionally. Discharge ascertained by applying gage height to rating table. Records fair.

harge measurements of Little Horn River near Crow Agency, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
	4.72	220	Aug. 6	4.60	187
	6.03	925	Sept. 1	4.38	123

discharge, in second-feet, of Little Horn River near Crow Agency, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	240	190		263	339	904	840	186	114
	240	178		263	386	970	840	186	104
	240	178		339	339	542	840	186	104
	240	178		339	339	570	840	186	104
	240	166		339	339	598	840	186	104
	240	158		295	339	598	488	186	104
	198	190		263	386	598	488	186	104
	240	206		263	542	627	436	186	104
	240	232		295	488	716	436	186	104
	240	232		275	488	840	436	186	129
	240	240		275	598	778	386	156	129
	240	219		255	542	904	386	156	129
	240	198		255	515	840	339	156	129
	240	198	904	275	515	716	339	156	129
	240	198	515	255	542	970	339	156	129
	198	206	386	255	598	1,040	339	156	129
	206	219	462	263	598	1,040	295	129	129
	206	206	462	263	598	1,180	295	129	156
	198	219	339	263	656	1,180	295	129	156
	198	206	317	263	686	1,320	295	129	156
	198	206	275	263	686	1,320	295	129	129
	198	198	275	263	716	1,250	255	129	129
	198		275	263	904	1,040	255	129	129
	190		275	263	716	970	219	104	129
	190		263	263	716	970	219	104	129
	190		226	263	716	904	219	104	129
	190		263	287	716	840	219	104	129
	178		263	287	686	840	186	104	129
	158		263	339	598	840	186	104	129
	178		295	339	598	840	186	104	129
	178		255		570		186	104	

Monthly discharge of Little Horn River near Crow Agency, Mont., for the year endin Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	240	158	213	13,10
November 1-22	240	158	201	8,77
March 14-31	904	226	351	12,50
April	339	255	280	16,70
May	904	339	563	34,60
June	1,320	542	892	53,10
July	840	186	394	24,20
August	186	104	146	8,98
September	156	104	125	7,44

LODGEGRASS CREEK AT LODGEGRASS, MONT.

Location.—In S. ½ sec. 13, T. 6 S., R. 35 E., 600 feet above Chicago, Burlington & Quincy Railroad bridge and one-fourth mile south of Lodgegrass, on Crow Indian Reservation, in Big Horn County.

Drainage area.—Not measured. 142 square miles at old site 6 miles upstream.

Records available.—March 24 to September 30, 1916, at present site; September 9, 1911, to December 28, 1915, at old site 6 miles upstream in S.W ¼ sec. 29, T. 6 S., R. 35 E., one-fourth mile above Lodgegrass ditch.

Gage.—October 1 to December 4 an overhanging chain gage at old site 6 miles upstream; March 24 to September 30 overhanging wire gage on left bank at different datum.

Discharge measurements.—Made from the railway bridge or by wading.

Channel and control.—Control is an outcrop of sandstone overlain with boulders and gravel; boulders and gravel likely to shift.

Extremes of discharge.—Maximum stage recorded during year, 3.60 feet June 20 (discharge, 355 second-feet); minimum stage, 1.80 feet September 9 and 13 (discharge, 11 second-feet).

1911-1916: Maximum stage, 7.0 feet June 13, 1915 (discharge, 695 second-feet); minimum stage, 1.80 feet September 9 and 13, 1916 (discharge, 11 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Lodgegrass ditch diverts water for irrigation about 6 miles above present site. Old station was about one-fourth mile above headworks of this ditch; hence flow during irrigation season is not comparable to that at present site.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by occasional shift in control. Gage read once daily to quarter tenths. Rating curve used as follows: October 1 to December 4, gage at old site 6 miles upstream, fairly well defined; March 24 to June 20, fairly well defined; July 8 to September 30, poorly defined. Discharge ascertained by applying daily gage height to rating table; shifting-control method used June 21 to July 7. Records good.

Discharge measurements of Lodgegrass Creek at Lodgegrass, Mont., during the year ending Sept. 30, 1916.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 24	2.06	47.8
June 2	2.86	151
Sept. 1	1.86	15.4

Daily discharge, in second-feet, of Lodgegrass Creek at Lodgegrass, Mont., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26	28	30	....	71	69	150	156	28	15
2	24	27	30	....	69	71	151	133	28	14
3	26	28	30	....	93	83	133	128	28	14
4	39	28	30	....	107	69	128	119	26	14
5	34	28	....	....	71	62	133	103	26	12
6	32	28	....	....	66	69	178	96	26	12
7	32	28	....	....	60	77	159	88	26	12
8	30	28	....	....	62	110	133	77	24	12
9	30	28	....	....	58	96	133	74	24	11
10	30	26	....	....	58	99	159	72	24	12
11	30	26	....	....	58	113	239	68	24	14
12	30	26	....	....	53	110	200	63	24	12
13	30	26	....	....	53	107	168	61	24	11
14	28	26	....	....	43	122	178	63	22	12
15	28	28	....	....	51	174	205	61	24	24
16	28	28	....	....	58	178	253	55	22	22
17	28	28	....	....	58	118	253	53	22	22
18	28	28	....	....	56	99	284	53	22	22
19	28	28	....	....	56	90	318	45	20	20
20	26	28	....	....	81	93	355	38	22	17
21	26	28	....	....	62	103	316	38	22	17
22	26	28	....	....	58	150	269	36	22	17
23	26	28	....	....	77	178	262	34	22	17
24	26	28	....	48	71	138	179	34	20	17
25	26	30	....	43	60	138	179	32	18	17
26	27	30	....	43	56	125	168	32	18	17
27	28	30	....	56	56	118	156	30	18	14
28	28	30	....	53	60	110	168	32	17	14
29	28	30	....	56	66	110	179	36	17	17
30	28	30	....	58	69	122	174	36	17	14
31	27	....	....	58	....	133	....	32	14	....

NOTE.—Records Oct. 1 to Dec. 4 show the flow at the old site 6 miles upstream. Data inadequate for determination of discharge Dec. 5–28; no gage-height record Dec. 29 to Mar. 23.

Monthly discharge of Lodgegrass Creek at Lodgegrass, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	39	24	28.5	1,750
November	30	26	28.0	1,670
December 1–4	30	30	30.0	238
March 24–31	58	43	51.9	824
April	107	43	63.9	3,800
May	178	62	111	6,820
June	355	128	199	11,800
July	156	30	63.8	3,920
August	28	14	22.3	1,370
September	24	11	15.5	922

NOTE.—See footnote to daily-discharge table.

TONGUE RIVER AT CARNEYVILLE, WYO.

Location.—In sec. 20, T. 57 N., R. 84 W., at highway bridge at Carneyville, in Sheridan County. Nearest important tributary, Goose Creek, enters 3 miles below.

Drainage area.—495 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 25, 1911, to October 31, 1912; April 4, 1915, to September 30, 1916.

Gage.—Chain gage on downstream side of bridge, read by Walter Bone.

Discharge measurements.—Made from two-span bridge or by wading.

Channel and control.—Bed composed of gravel and small boulders; shifts; no well-defined control. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 6.75 feet at 6 p. m. June 19 (discharge, 2,050 second-feet); minimum stage, 2.85 feet August 18, 19, 23, and 24 (discharge, 84 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 188 second-feet from Tongue River above station and 33 second-feet below.

Regulation.—None so far as known.

Accuracy.—Stage-discharge relation fairly permanent; shifts slightly at times. Rating curve fairly well defined between 100 and 1,300 second-feet. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Tongue River at Carneyville, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	M. N. Grant, jr.	3.15	140	June 5	H. K. Smith	5.30	1,200
Apr. 21	R. H. Fletcher	3.43	225	July 17	do	3.50	263

Daily discharge, in second-feet, of Tongue River at Carneyville, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	154	133		128	300	1,120	540	152	94
2	208	124		138	300	905	540	147	94
3	208	133		164	300	960	490	133	94
4	260	124		164	256	960	465	147	94
5	196	124		152	300	1,120	416	124	91
6	208	133		128	540	1,070	393	128	94
7	182	133		128	905	850	370	124	88
8	189	147		116	690	905	346	128	88
9	168	133		116	795	1,120	323	128	88
10	186	124		128	690	1,420	323	124	94
11	178	133		133	795	1,240	300	128	94
12	186	133		152	690	1,070	300	128	88
13	186	133		138	740	1,120	248	118	91
14	178	124		164	795	1,180	240	112	94
15	157	124	94	181	590	1,180	240	105	93
16	157	133	118	181	540	1,070	248	94	105
17	147	133	133	232	490	1,180	252	91	94
18	154	147	124	244	346	1,300	248	84	94
19	154	133	133	278	540	1,600	236	84	98
20	154	133	158	244	690	1,300	224	88	105
21	154	147	138	202	905	1,240	188	91	105
22	154	158	152	188	905	960	181	94	105
23	154	158	152	198	850	905	181	84	112
24	140	158	138	209	795	850	158	84	112
25	152	158	128	256	795	795	175	91	112
26	133	128	128	346	690	850	166	88	116
27	147	133	122	416	740	795	152	94	110
28	133	108	128	540	690	795	133	105	116
29	133	112	138	465	795	740	209	105	118
30	133	112	138	323	1,070	690	181	105	120
31	133		128		1,020		158	94	

Note.—Shifting control method used Oct. 1-24.

Monthly discharge of Tongue River at Carneyville, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	260	133	167	10,300
November	158	108	134	7,970
March 15-31	158	94	132	4,450
April	540	116	215	12,800
May	1,070	256	663	40,800
June	1,600	690	1,040	61,900
July	540	133	278	17,100
August	152	84	110	6,760
September	120	88	100	5,950

GOOSE CREEK AT SHERIDAN, WYO.

Location.—At West Loucks Street Bridge, Sheridan, in Sheridan County. Nearest tributary, Little Goose Creek, enters a short distance below.

Drainage area.—182 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 14, 1911, to October 31, 1912; April 1,1915, to September 30, 1916; August 1, 1895, to August 2, 1897, below mouth of Little Goose Creek. State engineer maintained station at this point during 1913.

Gage.—Vertical staff installed April 20, 1916, in inside face left abutment; read by Wm. Yeager. Original gage was vertical staff on pile pier of footbridge at City Park several hundred yards below present site. August 14, 1915, gage was moved to left abutment of footbridge, and referred to datum 1.00 foot higher.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of gravel. Control is 100 feet downstream at small rapids which shift somewhat during high water.

Extremes of discharge.—Maximum stage recorded during year, 4.5 feet at 3 p. m. June 19 (discharge, 1,270 second-feet); minimum stage, 0.39 foot at 5 p. m. August 5 (discharge, 4 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—During irrigation season greater part of flow is diverted above station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifted during high water. Rating curve used prior to April 20 fairly well defined below 600 second-feet; curve used after that date well defined below 800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Goose Creek at Sheridan, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	M. N. Grant, jr.	[a] 2.61	66	July 17	H. K. Smith	0.97	59
Apr. 20	R. H. Fletcher	1.41	74	Sept. 14	....do	.58	13.0
June 5	H. K. Smith	3.21	604				

[a] Refers to gage installed Aug. 14, 1915.

Daily discharge, in second-feet, of Goose Creek at Sheridan, Wyo., for the year endin Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	119	59	....	43	120	489	317	12	
2	136	57	....	49	120	470	287	8	
3	136	38	....	34	120	452	170	7	
4	136	63	....	49	139	470	193	5	
5	166	63	....	43	159	647	159	5	
6	160	63	....	30	218	302	139	4	
7	142	67	....	40	332	434	130	8	
8	154	71	....	30	287	416	149	8	
9	142	67	....	42	332	527	149	6	
10	133	75	....	35	272	775	149	4	1
11	136	59	....	46	287	775	149	5	1
12	154	49	....	63	245	689	139	5	1
13	93	56	....	56	218	647	112	6	1
14	84	75	....	56	205	689	82	8	1
15	79	108	....	56	193	689	74	7	1
16	77	108	....	61	159	606	72	8	1
17	77	98	....	63	159	775	59	7	1
18	75	108	35	66	149	910	48	7	1
19	71	111	30	69	181	1,180	40	7	1
20	71	142	39	73	205	1,140	27	7	1
21	69	61	59	80	258	820	22	6	1
22	63	173	46	80	287	732	20	6	2
23	63	163	43	88	258	566	16	6	2
24	59	127	35	96	258	272	15	7	1
25	61	114	30	96	272	245	9	6	1
26	57	75	40	96	272	245	8	7	1
27	57	103	33	112	348	364	6	7	1
28	56	114	30	149	258	398	5	8	2
29	56	75	35	120	317	416	15	8	2
30	56	75	25	130	381	398	15	8	2
31	59	....	22	....	508	....	12	8	......

NOTE.—Discharge Nov. 30 estimated because of ice; Apr. 18-19, interpolated. Shifting-control method used Apr. 20 to June 4.

Monthly discharge of Goose Creek at Sheridan, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	166	56	96.7	5,950
November	173	38	87.2	5,190
March 18-31	59	22	35.9	997
April	149	30	68.4	4,070
May	508	120	242	14,900
June	1,180	245	585	34,800
July	317	5	89.7	5,520
August	12	4	6.8	41
September	23	6	14.0	833

POWDER RIVER NEAR ARVADA, WYO.

LOCATION.—Near line between Tps. 56 and 57 N., R. 76 W., at State bridge, 17 miles north of Arvada, in Sheridan County. Nearest tributary, Clear Creek, enters 200 yards below.

DRAINAGE AREA.—6,580 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—Sept. 1, 1915, to Sept. 30, 1916.

GAGE.—Chain gage on upstream guard-rail of bridge since May 4, 1916; read by Miss Carrie Sorenson. Prior to May 4, 1916, gage was inclined staff 1 mile upstream, at K ranch.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of silt and gravel. Control just above mouth of Clear Creek; during high water backwater from Clear Creek may reach gage, as fall between station and creek is only 2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.0 feet July 29 (discharge, 6,080 second-feet); minimum discharge estimated at 1 second-foot for Sept. 14–19.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated divisions of 9 second-feet from Powder River, above the station. Between the station and State line there were adjudicated diversions of 39 second-feet from Powder River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; control shifting at intervals. Rating curve well defined below 2,000 second-feet but poorly defined above. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Powder River near Arvada, Wyo., during the period July 22, 1915 to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
22	R. H. Fletcher	3.00	346	Apr. 15	R. H. Fletcher	4.63	610
13	.....do	2.99	283	June 3	H. K. Smith	4.71	807
28	M. N. Grant, jr	[a] 2.98	277	July 14	.....do	4.16	367
				Sept. 13	.....do	2.51	[b] 1

[a] Read on old gage; gage height referred to datum of gage installed May 4, 1916, is 4.03 feet.
[b] Estimated.

NOTE.—Gage heights of measurements on and after April 15 refer to chain gage at bridge.

Daily discharge, in second-feet, of Powder River near Arvada, Wyo., for the period Sept. 1, 1915 to Sept. 30, 1916.

Day.	Sept.	Day.	Sept.	Day.	Sept.
1915.		1915.		1915.	
	311	11	925	21	311
	294	12	747	22	294
	2,900	13	588	23	271
	1,270	14	502	24	265
	5,470	15	486	25	255
	5,160	16	426	26	463
	2,320	17	294	27	2,380
	1,780	18	356	28	5,520
	1,240	19	343	29	2,100
	943	20	330	30	1,380

Daily discharge, in second-feet, of Powder River near Arvada, Wyo., for the period Sept. 1, 1915, to Sept. 30, 1916—Continued.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.								
1	1,020	265	....	....	712	242	316	....
2	835	271	....	....	712	200	162	....
3	662	277	....	....	712	159	143	....
4	356	277	....	577	692	130	132	....
5	580	282	....	500	762	119	4,740	....
6	502	288	....	466	762	104	602	....
7	426	294	....	433	664	124	1,680	....
8	463	306	....	674	459	135	560	....
9	294	300	....	875	485	91	305	....
10	330	306	....	1,080	500	84	189	....
11	356	343	....	875	530	76	189	....
12	323	306	....	1,000	611	740	189	....
13	317	294	....	850	552	378	189	1
14	330	288	....	712	522	354	189	1
15	323	282	674	664	478	305	189	1
16	317	250	....	560	466	305	182	1
17	306	240	....	500	452	305	182	1
18	356	....	....	466	402	305	182	1
19	356	....	....	466	452	305	182	1
20	349	....	....	472	850	305	182	13
21	294	....	....	538	1,280	305	182	19
22	282	....	....	664	5,270	305	182	22
23	265	....	....	664	2,920	305	182	24
24	265	....	....	938	850	305	....	26
25	271	....	....	875	552	305	....	28
26	282	....	....	664	414	305	....	32
27	282	....	....	674	366	305	....	32
28	282	....	....	620	344	305	....	34
29	277	....	....	664	310	6,080	....	32
30	271	....	....	664	290	1,280	....	34
31	265	....	....	664	....	560	....	....

NOTE.—Discharge, July 20-23, Aug. 21, and Sept. 15, estimated. No record Aug. 24 to Sept. 13, 1916, as gage was out of water.

Monthly discharge of Powder River near Arvada, Wyo., for the years ending Sept. 30, 1915, and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
September	5,520	255	1,330	79,100
1915-16.				
October	1,020	265	382	23,500
November 1-17	343	240	286	9,640
May 4-31	1,080	433	671	37,300
June	5,270	290	812	48,300
July	6,080	76	488	30,000
August 1-23	4,740	132	488	22,300
September 13-30	34	1	16.8	600

CLEAR CREEK NEAR ARVADA, WYO.

LOCATION.—In sec. 36, T. 57 N., R. 77 W., at Sorenson's ranch, 1½ miles above mouth of creek and 16 miles north of Arvada, in Sheridan County. No tributary between station and mouth.

DRAINAGE AREA.—1,110 square miles (measured on base map of Wyoming; scale 1:500,000).

RECORDS AVAILABLE.—August 8, 1915, to September 30, 1916.

GAGE.—Chain gage on right bank one-fourth mile below diversion dam at Sorenson's ranch; read by Miss Carrie Sorenson.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Multiple control consisting of two rock dikes across the river 150 feet apart; upper dike, 100 feet below gage, acts as low-water control; at high water lower dike is control. Banks not subject to overflow. Stage of zero flow, 3.8 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.14 feet at 10 a. m. June 20 (discharge, 1,410 second-feet); minimum discharge probably occurred during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31 1918, there were adjudicated diversions of 428 second-feet from Clear Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; control apparently shifts occasionally. Rating curve fairly well defined between 18 and 800 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Clear Creek near Arvada, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	M. N. Grant, jr	4.81	140	July 14	H. K. Smith	4.60	94
Apr. 14	R. H. Fletcher	5.04	199	Sept. 13	....do	4.22	a 4
June 3	H. K. Smith	6.22	791				

a Estimated.

Daily discharge, in second-feet, of Clear Creek near Arvada, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	212	139	....	381	982	487	78	1
2	212	139	....	336	882	295	56	3
3	212	129	....	336	814	227	36	2
4	212	129	....	336	848	242	22	1
5	212	139	....	357	848	198	17	2
6	198	139	....	548	982	129	20	1
7	242	150	....	647	748	108	11	1
8	212	150	....	882	647	50	24	1
9	198	150	....	714	614	61	11	2
10	185	150	....	781	714	64	9	1
11	173	139	....	781	1,120	242	3	2
12	185	129	....	781	1,050	161	2	4
13	185	119	....	647	781	119	3	3
14	185	119	199	580	714	93	2	4
15	173	119	357	516	680	61	3	5
16	173	119	357	487	680	59	6	6
17	161	139	314	432	516	45	17	10
18	161	....	314	432	647	38	12	13
19	173	....	295	458	714	38	9	12
20	161	....	295	458	1,380	41	3	10
21	150	....	259	614	882	48	5	10
22	150	....	242	848	1,180	40	6	10
23	150	....	242	882	1,050	30	8	12
24	139	....	259	848	580	28	4	10
25	139	....	276	680	432	26	3	17
26	139	....	314	781	381	20	3	16
27	139	....	314	748	276	13	4	18
28	139	....	336	614	487	15	3	28
29	139	....	357	647	487	16	3	26
30	139	....	405	680	548	100	2	28
31	139	....	....	882	....	93	3	....

Monthly discharge of Clear Creek near Arvada, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	242	139	174	10,700
November 1-17	150	119	135	4,560
April 14-30	405	199	302	10,200
May	882	336	617	37,900
June	1,380	276	755	44,900
July	487	13	103	6,330
August	78	2	12.5	769
September	28	1	8.6	512

PINEY CREEK AT KEARNEY, WYO.

Location.—In sec. 26, T. 53 N., R. 83 W., at highway bridge 300 yards south of Kearney, in Johnson County.

Drainage area.—117 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—September 6, 1902, to June 30, 1906; May 13, 1911, to October 31, 1912; April 24, 1915, to September 30, 1916.

Gages.—Chain gage on downstream side of bridge; read by Mrs. Lena Noyce. Gage used 1902-1906 was at same site but referred to different datum.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Channel composed of gravel and small boulders. Control 100 feet downstream at well defined rapids which were permanent during 1916. At stage of approximately 5 feet, water begins to flow through a small channel at the left bank which diverts water from Piney Creek some distance above the station.

Extremes of discharge.—Maximum stage recorded during year, 4.0 feet at 8 a. m. June 10 (discharge, 911 second-feet); minimum stage, 1.25 feet for several days in September (discharge, 12 second-feet).

Ice.—Stage discharge relation affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 278 second-feet from Piney Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 13 and 900 second-feet. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Piney Creek at Kearney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	M. N. Grant, jr.	1.68	31.4	June 6	H. K. Smith	3.30	458
Apr. 18	R. H. Fletcher	2.34	141	July 15	do	1.78	42.1
Apr. 20	do	2.26	121				

Daily discharge, in second-feet, of Piney Creek at Kearney, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	48	25	....	59	173	678	136	44	16
2	48	40	....	46	173	678	160	34	14
3	48	54	....	45	173	678	173	28	13
4	48	54	....	46	200	678	121	23	12
5	48	54	....	46	229	678	54	26	12
6	37	54	....	46	313	471	54	30	12
7	32	54	....	46	313	374	59	25	13
8	32	54	....	46	374	527	90	25	13
9	42	54	....	54	420	527	125	28	13
10	48	54	....	72	420	775	143	26	13
11	48	54	....	70	332	586	104	26	13
12	42	54	46	108	277	446	63	25	13
13	42	54	46	90	277	420	46	23	13
14	42	54	36	99	214	374	39	23	13
15	42	54	36	106	229	313	42	23	13
16	42	54	36	119	214	332	70	25	13
17	42	54	36	125	200	294	56	26	13
18	42	54	41	134	200	260	39	26	13
19	42	54	46	136	200	678	34	23	12
20	42	54	46	114	294	527	26	26	12
21	42	54	72	114	294	420	19	30	12
22	42	54	59	125	374	527	23	34	12
23	42	54	62	125	374	294	20	34	23
24	37	54	59	125	332	214	20	26	44
25	37	54	76	125	374	200	21	20	42
26	25	48	62	125	332	229	20	14	34
27	32	42	59	160	332	294	28	16	30
28	32	42	59	200	374	260	50	15	25
29	32	42	59	173	353	313	148	14	19
30	32	42	59	173	471	244	100	14	18
31	32	....	81	....	586	....	56	15	....

NOTE.—Discharge Nov. 28–30 estimated.

Monthly discharge of Piney Creek at Kearney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	48	25	40.1	2.470
November	54	25	50.8	3.020
March 12–31	81	36	53.8	2.130
April	200	45	102	6.070
May	586	173	304	18.700
June	775	200	443	26.400
July	173	19	69.0	4.240
August	44	14	24.7	1.520
September	44	12	17.3	1.030

LITTLE MISSOURI RIVER BASIN.

LITTLE MISSOURI RIVER NEAR ALZADA, MONT.

LOCATION.—Near southwest corner of T. 8 S., R. 60 E., at Walker's ranch, 300 yards below site of proposed dam, 2 miles below mouth of Thompson Creek, 4 miles below Alzada, in Fallon County.

DRAINAGE AREA.—About 780 square miles.

RECORDS AVAILABLE.—June 18, 1911, to September 30, 1916; April 3, 1904, to November 30, 1906, at Alzada above Thompson Creek.

GAGE.—Overhanging chain gage on right bank read by John Walker; gage used during 1911 was vertical staff on left bank 150 feet downstream. Datum of chain gage 0.08 feet lower than that of staff gage.

Discharge measurements.—Made by wading or from cable.

Channel and control.—Bed of channel shifts during high water. Stream sluggis Banks cut 5 to 15 feet in sandy soil. Two channels at medium and one at hig stage. Point of zero flow at gage height 1.8 feet; determined by levels, Septem ber 14, 1916.

Extremes of discharge.—Maximum stage recorded during year, 8.18 feet at 3. p. m. and 4.45 p. m. March 12 (discharge 1,490 second-feet); minimum stag 1.80 feet, or less, September 8–10 and 12–30 (discharge, 0).

1911–1916: Maximum stage recorded 15.3 feet April 6, 1912 (discharge, 4,55 second-feet); channel dry July 6 to August 7, and October 14–18, 1911; Septemb 9–15, 1913; and September 8–10 and 12–30, 1916.

Ice.—Stage-discharge relation seriously affected by ice; winter flow estimated fro observer's notes and weather records.

Diversions.—None.

Regulation.—None of importance. Some flood water in spring is stored in coulee on tributaries for use in irrigating small tracts.

Accuracy.—Stage-discharge relation permanent during year, except as affected b ice for short periods in January, February, and March. Rating curve well defined Gage read to quarter tenths twice daily; during high water and changing stages read more often. Discharge ascertained by applying mean daily gage height t rating table, except for periods during which stage-discharge relation is affecte by ice. Record obtained by use of rating table, good; other records, fair.

Daily discharge, in second-feet, of Little Missouri River near Alzada, Mont., for the yea ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	39	14	16	16	....	200	66	16	20	32	184	1.
2	30	13	16	16	....	140	228	16	20	23	151	1.
3	30	14	16	16	....	120	265	16	18	16	30	.
4	26	17	16	16	....	106	430	15	17	12	24	.
5	24	18	16	15	....	76	228	13	22	12	17	.
6	49	16	16	14	....	62	140	12	44	10	28	.
7	32	16	16	14	....	54	104	12	33	10	265	.
8	28	16	16	14	....	91	76	12	27	9.5	240	.
9	23	15	16	13	....	488	56	12	19	7.6	278	.
10	19	14	16	14	....	336	45	10	15	24	43	.
11	19	20	14	14	....	1,080	42	11	18	50	27	.
12	19	19	14	14	....	1,470	44	12	22	52	162	.
13	18	16	14	13	....	818	40	14	19	30	228	.
14	16	14	13	12	....	206	31	27	20	17	57	.
15	14	12	13	10	....	115	24	488	16	14	36	.
16	16	14	13	10	30	83	31	368	15	12	20	.
17	16	14	12	10	618	52	20	228	15	12	14	.
18	16	18	12	10	880	40	22	195	12	45	12	.
19	17	16	12	10	1,080	32	33	91	11	184	8.0	.
20	16	16	12	....	1,340	30	41	56	13	70	8.0	.
21	16	15	12	....	1,470	32	28	45	24	99	9.5	.
22	15	15	14	....	1,360	34	22	46	19	59	9.5	.
23	14	16	14	....	1,110	26	19	71	67	21	6.8	.
24	15	16	14	....	794	26	19	116	58	16	6.0	.
25	14	15	14	....	818	25	18	57	48	17	4.0	.
26	14	15	14	....	840	24	16	45	24	12	4.4	.
27	13	15	14	....	710	28	14	33	24	10	4.0	.
28	14	15	13	....	306	26	16	25	97	10	4.0	.
29	14	15	12	....	250	39	16	22	336	65	4.4	.
30	14	15	12	....	....	50	16	24	99	50	3.4	.
31	15	....	12	....	....	44	....	19	....	140	2.2	....

Note.—Discharge Jan. 20 to Feb. 15 estimated, because of ice, at 5 second-feet; Feb. 29 and Mar. 1, interpolated because of ice.

Monthly discharge of Little Missouri River near Alzada, Mont., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	38	13	20.1	1,240
November	20	12	15.5	922
December	16	12	14.0	861
January	16	....	10.0	615
February	1,470	....	403	23,200
March	1,470	24	192	11,800
April	430	14	71.7	4,270
May	488	10	68.6	4,220
June	336	11	39.7	2,360
July	184	7.6	36.8	2,260
August	278	2.2	61.0	3,750
September	1.9	.0	.17	10
The year	1,470	.0	76.5	55,500

KNIFE RIVER BASIN.

KNIFE RIVER NEAR BRONCHO, N. DAK.

LOCATION.—In SE. ¼ sec. 4, T. 142 N., R. 90 W., at C. D. Smith's ranch, half mile below mouth of Elm Creek, 15 miles above Spring Creek, and 6 miles from Broncho, in Mercer County.

DRAINAGE AREA.—1,260 square miles; drainage area at old station two miles below present site is probably about 5 square miles greater.

RECORDS AVAILABLE.—May 29, 1903, to September 30, 1916.

GAGE.—Chain gage on left bank just below observer's house; datum unchanged since March 23, 1905, when station was moved from original site. Gage read by C. D. Smith.

DISCHARGE MEASUREMENTS.—Made from cable 500 feet below gage, or by wading.

CHANNEL AND CONTROL.—Control shifts occasionally, causing slight changes in rating curve for low stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, 21.1 feet March 28–29 (stage-discharge relation seriously affected by ice; discharge not computed); minimum stage recorded, 3.4 feet August 2–5, 19–31, September 1–8, 18–30 (discharge, 7 second-feet).

1903–1916: Maximum stage recorded, 24.0 feet June 26, 1914, determined by leveling from flood marks, (discharge computed from extension of rating curve, 7,700 second-feet); river reported dry September 6–8, 1905; September 18–19, 1908.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

ACCURACY.—Stage-discharge relation not permanent owing to slight changes in control. Two rating curves fairly well defined below 2,000 second-feet used October 1 to June 24 and June 25 to September 30, 1916. Gage read once daily to tenths. Discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Knife River near Broncho, N. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 26	W. B. Stevenson	5.75	248
Sept. 1	E. F. Chandler	3.44	8.8

Daily discharge, in second-feet, of Knife River near Broncho, N. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	17	12	437	63	38	627	11	7
2	17	12	1,690	63	38	210	7	7
3	38	12	4,600	56	38	124	7	7
4	50	12	4,280	56	38	101	7	7
5	194	12	2,540	50	38	71	7	7
6	137	12	1,320	44	38	40	16	7
7	374	12	655	44	38	33	21	7
8	395	12	458	38	38	33	33	7
9	164	12	334	38	32	27	33	11
10	114	12	1,100	38	32	27	33	11
11	70	12	1,060	38	32	80	33	11
12	50	12	502	44	32	124	33	11
13	22	12	315	44	32	47	27	11
14	22	12	226	44	32	47	21	11
15	17	....	137	44	27	40	21	11
16	17	....	95	44	27	33	11	11
17	17	....	63	38	27	33	11	11
18	17	....	56	38	27	27	11	7
19	17	....	56	38	27	11	7	7
20	17	....	800	38	27	16	7	7
21	17	....	3,420	38	27	16	7	7
22	17	....	4,100	38	32	16	7	7
23	17	....	958	38	480	16	7	7
24	17	....	925	38	860	16	7	7
25	12	....	712	86	800	16	7	7
26	12	....	278	78	480	11	7	7
27	12	....	194	63	334	11	7	7
28	12	....	95	56	278	11	7	7
29	12	....	86	50	296	11	7	7
30	12	....	70	44	437	11	7	7
31	12	....	....	38	....	11	7	....

NOTE.—Flow Nov. 15–30 estimated at 12 second-feet.

Monthly discharge of Knife River near Broncho, N. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	395	12	61.9	3,810
November	....	....	12.0	714
April	4,600	56	1,050	62,500
May	86	38	47.3	2,910
June	860	27	156	9,280
July	627	11	61.2	3,760
August	33	7	14.0	861
September	11	7	8.2	488

HEART RIVER BASIN.

HEART RIVER NEAR RICHARDTON, N. DAK.

LOCATION.—In sec. 21, T. 138 N., R. 92 W., opposite observer's house, 1 mile below highway bridge and about 11 miles south of Richardton, in Stark County.

DRAINAGE AREA.—1,250 square miles.

RECORDS AVAILABLE.—May 18, 1903, to September 30, 1916.

GAGE.—Overhanging chain gage installed May 31, 1913, opposite observer's house. Gages previously used as follows: May 18, 1903, to November 26, 1910, chain gage at highway bridge 1 mile above, set so that readings from it are approximately 20 feet less than those from present gage; March 10, to September 3, 1911, a staff gage 30 rods upstream from observer's house, set to read same as gage at highway bridge; September 4, 1911, to March 31, 1913, chain gage (at present site), which was set to same datum as present gage, was washed out March 30–31, and replaced

May 31, 1913, by present gage, which has been used since that date except February 20 to May 16, 1916, when, owing to damage caused by ice, the chain gage at highway bridge was read. Gage read by W. F. Church.

DISCHARGE MEASUREMENTS.—At high stages made from highway bridge 1 mile above gage; at low stages by wading at different sections near gage.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; shifting. During 1916 a dam built by beavers one-fourth mile below gage caused backwater at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 34.7 feet April 4 (discharged 2,470 second-feet); minimum stage, 24.55 feet at 7.30 a. m. August 20 (discharge 0.6 second-foot).

1903–1916: Maximum stage, 25.9 feet (chain gage at highway bridge) June 10, 1906 (discharge, 8,020 second-feet); river reported dry July 26–August 11, August 20–23, 1903, September 1–19, 1905, July 22–27, 1914.

ICE.—Stage-discharge relation seriously affected by ice; flow not computed for winter months.

ACCURACY.—Stage-discharge relation seriously affected by dam built by beavers. Rating curve used April 1 to May 1 fairly well defined. Gage read once daily to half tenths. Discharge determined by shifting-control method except for period April 1 to May 1, for which it was ascertained by applying daily gage height to rating table. Records poor, owing to operations of beavers.

Discharge measurements of Heart River near Richardton, N. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 25	W. B. Stevenson	28.99	832
May 16	Harris Robinson	25.40	60
Sept 3	E. F. Chandler	24.97	4.6

Daily discharge, in second-feet, of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.
1	15	24	585	256	45	102	3.0
2	10	24	966	226	41	113	3.0
3	8	24	1,070	196	41	138	3.0
4	60	24	2,470	181	36	102	3.0
5	70	17	1,760	152	41	80	4.0
6	70	24	1,070	152	41	65	8.0
7	70	20	862	125	50	60	8.0
8	91	24	629	113	41	50	6.0
9	91	24	565	102	41	65	55
10	70	17	1,500	91	36	65	55
11	55	11	1,100	80	32	75	17
12	41	11	629	80	32	80	14
13	41	17	428	80	32	96	8.0
14	32	20	337	91	28	80	6.0
15	28	20	304	102	20	65	3.0
16	24	20	288	80	20	50	2.5
17	24	24	256	60	20	41	2.0
18	20	24	241	60	17	36	1.6
19	24	17	673	55	17	28	1.3
20	14	17	1,670	55	24	24	.6
21	17	....	1,580	60	24	17	.8
22	24	....	2,280	60	20	14	1.3
23	28	....	2,190	70	119	11	1.6
24	28	....	2,030	60	211	36	2.0
25	24	....	1,020	70	651	17	2.5
26	24	....	585	70	1,070	14	2.0
27	24	....	545	70	565	14	2.0
28	24	....	354	60	226	11	2.0
29	28	....	304	55	152	11	2.0
30	28	....	256	50	125	11	2.5
31	24	....	....	45	....	2	3.0

NOTE.—Data inadequate for determination of discharge Nov. 21 to Mar. 31 and Sept. 1–30.

Monthly discharge of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	91	8	36.5	2,240
November 1-20	24	11	20.2	801
April	2,470	241	952	56,600
May	256	45	97.0	5,960
June	1,070	17	127	7,560
July	138	2	50.7	3,120
August	55	.6	7.28	448

CANNONBALL RIVER BASIN.

CANNONBALL RIVER AT STEVENSON, N. DAK.

Location.—In sec. 20, T. 133 N., R. 82 W., on Standing Rock Indian Reservation, at F. H. Bingenheimer's house on old Stevenson ranch, 1 mile below M. H. Burdick's house, 5 miles east of present location of Stevenson post office [1], about 4 miles southeast of Timmer, and 4 miles above mouth of Dogtooth Creek.

Drainage area.—3, 650 square miles.

Records available.—June 10, 1903, to November 30, 1908; August 9, 1911, to September 30, 1916.

Gage.—October 1, 1914, to September 1, 1915, chain on projecting cantilever timber on left bank at M. H. Burdick's house; read by Mrs. M. H. Burdick. Gage used from 1903 to 1908 was a chain on projecting timber of left bank 1 mile below Burdick's house; this gage was rebuilt September 1, 1915, and has been read daily since September 2 by Frank Bingenheimer. Datum of the two gages so related that readings on the gage at Burdick's are about 10.0 feet greater than on the gage at Bingenheimer's.

Discharge measurements.—At low and medium stages made by wading at ford 15 rods below Burdick's or at the riffle 55 rods below; at medium and high stages from cable about 100 yards above the gage installed September 2, 1915, at Bingenheimer's ranch.

Channel and control.—Bed of stream composed of gravel and stones, in places covered with silt to depth of 1 foot; shifts slightly.

Extremes of discharge.—Maximum stage recorded during year, 11.2 feet (ice running) March 18, 1916; maximum stage recorded, open season, 8.9 feet April 13, 1916 (discharge, 3,900 second-feet); minimum stage recorded, 2.8 feet September 27, 1916 (discharge, 8 second-feet.)

1903–1908 and 1911–1916: Maximum stage recorded, 21.0 feet April 2, 1912 (discharge, 6,360 second-feet); channel reported dry August 12-15, September 10, 11, 1904, September 29 to October 15, 1905, October 22, 25, November 24, 1906, September 2–7, 10–18, 22–28, October 7, 23, 26, November 24, 1907, August 27, 28, September 13–16, 21–23, October 3–6, 11, 12, 31, November 3–7, 10–14, 1908, and September 2, 1913.

Winter flow.—Stage-discharge relation affected by ice; data insufficient to warrant estimates of flow.

Accuracy.—Stage-discharge relation practically permanent during year except as affected by ice. Rating curve well defined. Gage read twice daily to half tenths. Discharge ascertained by applying mean daily gage height to rating table, except November 11 to March 31 for which data are inadequate for determination of flow. Records good.

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[1] Stevenson post office has been moved 5 miles west of former location.

Discharge measurements of Cannonball River at Stevenson, N. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 20	V. H. Sprague	7.00	2,200	Aug. 30	E. F. Chandler	2.94	17.4
21	do	6.00	1,420	Sept. 21	do	2.88	13.4
June 5	do	3.52	101				

Daily discharge, in second-feet, of Cannonball River at Stevenson, N. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	47	47	1,310	480	147	175	34	14
2	47	47	1,240	375	122	175	23	14
3	325	47	1,380	375	122	240	34	14
4	1,590	47	2,360	325	122	122	34	14
5	535	47	1,960	280	161	100	34	14
6	240	47	1,590	280	175	100	62	23
7	147	47	1,450	280	161	100	80	240
8	240	34	1,660	240	175	80	47	122
9	175	34	1,660	190	90	80	34	47
10	147	34	2,690	161	100	62	34	23
11	122		3,230	161	100	62	34	28
12	122		3,800	161	100	62	23	23
13	80		3,900	222	90	62	23	23
14	80		2,520	240	100	62	23	23
15	80		1,450	1,450	100	62	23	18
16	80		1,100	650	90	47	23	18
17	80		900	375	84	34	14	14
18	80		680	280	100	34	14	14
19	80		590	240	80	34	14	14
20	80		2,200	205	80	23	14	14
21	62		1,660	240	122	23	80	14
22	62		2,780	280	100	34	122	14
23	62		3,140	240	122	34	62	11
24	62		2,690	240	122	34	47	8
25	62		2,040	205	122	34	47	8
26	47		1,660	205	122	34	34	8
27	47		1,380	175	122	23	23	8
28	47		900	175	100	23	23	8
29	47		710	175	100	23	23	8
30	47		535	147	100	62	23	8
31	47			147		47	14	

Monthly discharge of Cannonball River at Stevenson, N. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,590	47	160	9,840
November 1-10	47	34	43.1	855
April	3,900	535	1,840	109,000
May	1,450	147	297	18,300
June	175	80	114	6,780
July	240	23	67.3	4,140
August	122	14	36.1	2,220
September	240	8	27.0	1,610

GRAND RIVER BASIN.

NORTH BRANCH OF GRAND RIVER AT HALEY, N. DAK.

Location.—Near northeast corner sec. 36, T. 129 N., R. 100 W., about 20 rods south of post office at Haley, in Bowman County.

Drainage area.—500 square miles.

Records available.—May 17, 1908, to September 30, 1916.

Gage.—Stage obtained by measuring distance from bench mark on highway bridge to water surface by means of metallic tape weighted at the end. From 1908 to 1911 a vertical staff gage 100 feet upstream from bridge was used. Observations made by H. N. Lungwitz.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed of stream composed of gravel and silt. Control shifts occasionally.

Extremes of discharge.—Maximum stage record during year, 8.6 feet February 21 (stage-discharge relation seriously affected by ice, discharge not computed); minimum stage recorded, 1.05 feet August 20 to September 30 (discharge 1.3 second-feet).

1908–1916: Maximum stage recorded 9.85 feet at 12 m. March 31, 1913 (discharge, from measurement, 5,810 second-feet); river reported dry August 9–15, 1908, October 1 to November 8, 1913, May 25 to June 13, 1914.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued.

Accuracy.—Stage-discharge relation not permanent; affected by shifting control. Stage read to half tenths twice daily. Daily discharge obtained by applying mean daily gage height to rating table for 1914. Records subject to error, as no discharge measurements were made during the year.

Daily discharge, in second-feet, of North Branch of Grand River at Haley, N. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July	Aug.	Sept.
1	3.4	8	22	30	108	11	1.3
2	3.4	78	16	19	120	9	1.3
3	3.4	86	8	13	84	6	1.3
4	3.4	108	7	11	72	5	1.3
5	3.4	114	9	9	39	5	1.3
6	3.4	132	16	7	16	5	1.3
7	3.4	84	7	5	11	5	1.3
8	3.4	62	5	5	11	5	1.3
9	3.4	39	3	3	11	5	1.3
10		22	2	4	16	4	1.3
11		22	2	5	13	3	1.3
12		16	1	6	13	3	1.3
13		22	1	7	16	8	1.3
14		21	1	7	22	3	1.3
15		20	3	8	22	3	1.3
16		22	13	9	22	3	1.3
17		27	13	10	16	8	1.3
18		22	39	11	39	3	1.3
19		84	13	11	49	3	1.3
20		240	16	16	30	1.3	1.3
21		213	16	11	30	1.3	1.3
22		126	11	7	39	1.3	1.3
23		49	11	7	39	1.3	1.3
24		44	16	11	39	1.3	1.3
25		30	22	16	34	1.3	1.3
26		28	16	30	30	1.3	1.3
27		22	22	30	22	1.3	1.3
28		26	30	49	22	1.3	1.3
29		22	30	84	22	1.3	1.3
30		22	30	96	19	1.3	1.3
31			32		13	1.3	

Monthly discharge of North Branch of Grand River at Haley, N. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1-9	3.4	3.4	3.40	60.7
April	240	3	60.0	3,570
May	39	1	14.0	861
June	96	3	17.9	1,070
July	120	11	33.5	2,060
August	11	1.3	3.31	204
September	1.3	1.3	1.30	77.4

GRAND RIVER NEAR WAKPALA, S. DAK.

LOCATION.—In or near sec. 8, T. 19 N., R. 29 E., on Standing Rock Indian Reservation at new steel highway bridge 4 miles south of Wakpala, Corson County, a station on Chicago, Milwaukee & St. Paul Railway.

DRAINAGE AREA.—5,300 square miles.

RECORDS AVAILABLE.—September 9, 1911, to September 30, 1916.

GAGE.—Chain gage on foot guardrail downstream side of highway bridge; read by James Soft.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading at ford 40 rods below bridge.

CHANNEL AND CONTROL.—Bed composed of soft silt or quicksand; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.6 feet at 5 p. m, April 20 (discharge, 3, 260 second-feet); minimum stage recorded, 4.3 feet September 23 (discharge, 15 second-feet).

1911–1915: Maximum stage recorded June 17 and 19, 1915 (discharge, 7,130 second-feet); minimum stage recorded, 1.8 to 2.2 feet September 13–15 and September 21 to October 1, 1913 (discharge, 0.1 second-foot).

ICE.—Stage-discharge relation seriously affected by ice; data insufficient to warrant estimates.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves used, applicable as follows: October 1–12, 1915, fairly well defined; October 20 to November 28, poorly defined; April 1 to September 30, fairly well defined. Gage read once daily to tenths; readings believed to be fairly accurate and reliable, although occasionally they do not check with those made by engineers. Discharge ascertained by applying daily gage height to rating table; shifting-control method used October 13–19. Records fair.

Discharge measurements of Grand River near Wakpala, S. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
[illegible] 30	V. H. Sprague	4.15	84	Aug. 29	E. F. Chandler	4.61	50
Apr. 22	.....do	9.74	3,040	Sept. 19	.....do	4.60	43
[illegible] 8	.....do	5.22	139				

Daily discharge, in second-feet, of Grand River near Wakpala, S. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	214	72	1,220	686	960	215	....	2
2	160	66	1,640	581	940	185	....	2
3	160	61	2,060	478	920	185	....	2
4	1,960	56	2,060	375	860	185	....	2
5	1,740	56	2,060	332	800	166	....	2
6	1,740	56	2,160	290	590	148	....	25
7	1,580	56	2,260	250	380	130	....	772
8	1,410	....	2,360	238	170	130	....	1,520
9	1,190	....	2,480	226	170	65	....	1,520
10	1,140	....	2,300	215	170	50	....	1,160
11	1,030	....	2,120	215	178	42	....	1,220
12	918	....	1,940	200	185	35	....	1,280
13	790	....	1,760	200	258	50	....	1,040
14	660	....	1,730	200	330	35	....	810
15	530	....	1,700	2,600	291	85	....	575
16	410	....	1,100	2,540	253	....	....	520
17	278	....	1,100	1,760	215	....	....	312
18	207	....	1,880	1,520	185	....	....	105
19	136	....	2,570	1,190	800	....	....	42
20	118	....	3,260	860	890	....	....	34
21	100	....	2,960	800	980	....	....	25
22	96	....	2,780	800	832	....	....	20
23	92	....	2,390	685	685	....	....	15
24	78	....	2,000	920	330	....	....	50
25	78	....	1,760	860	310	....	....	25
26	78	....	1,600	800	290	....	....	25
27	78	....	1,430	800	265	....	....	25
28	78	....	1,270	860	240	....	....	25
29	66	....	1,100	900	215	....	50	25
30	85	....	890	940	215	....	35	25
31	72	....	....	980	....	....	35	....

NOTE.—Discharge interpolated for lack of gage readings on following days: Oct. 1, 11, 13–15, 18, 20, 22, 26–27; Nov. 2, 3, and 5; Apr. 4, 6, 7, 10, 14, 19, 23, 26–28, and 30; May 2, 3, 5, 8, 9, 19, 29–30; June 1, 2, 4, 6, 7, 9, 11, 13, 15, 16, 20, 22, 25, 27, 28, and 30; July 5, 6, and 11; Sept. 7, 11, 13, 14, 17, 20, 22, and 27–29.

Monthly discharge of Grand River near Wakpala, S. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,960	66	557	34,200
November 1-7	72	56	60.4	839
April	3,260	890	1,930	115,000
May	2,600	200	784	48,200
June	980	170	464	27,600
July 1-15	215	35	110	3,270
September	1,520	15	377	22,400

CHEYENNE RIVER BASIN.

CHEYENNE RIVER NEAR HOT SPRINGS,[1] S. DAK.

LOCATION.—In sec. 9, T. 9 S., R. 5 E., a mile above dam site of proposed Angostura irrigation project, 5 miles south of Cascade Springs, and 11 miles south of Hot Springs, in Fall River County. Nearest tributary, Cascade Creek, enters 2½ miles above.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 11, 1914, to September 30, 1916. Station maintained at Edgemont June 19, 1903, to November 30, 1906, but flow is not directly comparable as a number of small tributaries intervene.

GAGE.—Inclined slope gage on right bank one-third mile below Noerenberg's fruit farm; read by Fred Noerenberg. Friez water-stage recorder used prior to April 2, 1915, but abandoned as stream carries too much silt during flood.

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[1] Formerly Cheyenne River near Cascade Springs, S. Dak.

Discharge measurements.—Made by wading or from cable 75 feet below gage.

Channel and control.—Bed composed of compacted gravel on which silt is deposited; shifts frequently. Principal control a short distance down stream; shifts during severe floods. Right bank subject to overflow for distance of 100 feet at stage of 14 feet.

Extremes of discharge.—Maximum stage recorded during year, 7.2 feet at 6 p. m., June 21 (discharge, 6,140 second-feet); minimum stage, 0.84 foot, September 12–14 (discharge, 24 second-feet).

Ice.—Spring water from Cascade Creek prevents formation of ice except for brief periods.

Diversions.—Permits granted for diversions amounting to 93.4 second-feet from Cheyenne River, and 43.4 second-feet from Cascade Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts frequently; affected by ice for short periods. Rating curve used as standard fairly well defined between 24 second-feet and 24,000 second-feet. Frequent discharge measurements made to define shifts of control. Gage read to half tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table; shifting-control method used April 1 to September 30. Records good.

Discharge measurements of Cheyenne River near Hot Springs, S. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 25	Fred Noerenberg	1.25	52	July 10	Fred Noerenberg	0.87	24.5
May 22	do	3.01	1,140	12	Smith and Noerenberg.	4.06	1,840
June 6	do	1.60	235	Aug. 17	Fred Noerenberg	1.32	76
10	do	1.28	109	Sept. 15	do	.87	24.1
28	do	1.53	129				

Daily discharge, in second-feet, of Cheyenne River near Hot Springs, S. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,110	230	118	80	39	188	230	220	286	258	604	160
2	895	230	105	80	44	105	212	202	382	192	337	122
3	762	212	105	80	52	112	130	184	670	105	373	74
4	670	230	105	80	52	118	160	151	700	68	298	37
5	599	212	105	70	52	355	130	145	450	52	122	32
6	555	212	118	70	52	355	160	130	250	37	85	30
7	500	212	118	70	52	360	178	125	181	33	57	30
8	460	212	105	70	52	400	178	125	151	30	1,490	30
9	450	195	130	160	52	290	242	125	118	28	622	30
10	410	195	130	195	44	525	223	125	1,230	26	415	28
11	355	195	130	130	44	400	246	108	610	178	435	25
12	346	160	105	28	44	525	246	125	622	2,000	294	24
13	364	160	105	52	1,580	610	238	167	1,350	540	274	24
14	332	130	105	44	2,000	355	220	154	1,780	360	223	24
15	332	130	92	60	3,770	212	195	139	990	282	98	25
16	355	130	92	44	4,700	212	181	238	373	420	74	26
17	355	195	92	52	2,460	160	181	294	209	3,220	90	26
18	555	178	80	60	1,890	118	181	220	110	2,110	64	26
19	450	160	80	70	1,580	136	282	184	178	1,160	49	28
20	378	130	80	80	1,310	136	302	167	142	540	110	28
21	310	130	80	80	1,190	145	284	2,340	4,020	226	110	26
22	332	130	92	80	795	145	450	1,430	2,730	122	85	28
23	290	130	105	60	599	130	364	795	1,440	105	80	30
24	250	160	118	60	640	130	302	455	884	85	74	28
25	270	212	105	52	582	105	250	368	535	74	85	26
26	250	160	80	44	525	105	216	455	396	57	64	26
27	250	130	80	39	475	136	250	455	278	40	98	26
28	250	130	80	31	370	130	230	368	160	43	223	26
29	230	130	80	28	270	160	216	254	535	49	258	25
30	230	130	80	39		230	184	167	278	776	258	24
31	230		80	34		250		125		1,300	206	

Note.—Stage-discharge relation affected by ice Jan. 12–19, 26–31, Feb. 1–7, 28, and Mar. 1–3. Shifting control method used Apr. 1 to Sept. 30.

Monthly discharge of Cheyenne River near Hot Springs, S. Dak., for the year endin Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,110	230	423	26,00
November	230	130	172	10,20
December	130	80	99.4	6,11
January	195	28	68.5	4,21
February	4,700	39	873	50,20
March	860	105	253	15,60
April	450	130	229	13,60
May	2,340	103	340	20,90
June	4,020	110	73.5	43,70
July	3,220	23	468	28,80
August	1,490	49	247	15,20
September	160	24	36.5	2,17
The year	4,700	24	326	237,00

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

Location.—In sec. 2, T. 8 N., R. 2 E., at diversion dam of Belle Fourche irrigation project, 1½ miles below Belle Fourche, in Butte County.

Drainage area.—4,270 square miles.

Records available.—May 10 to November 30, 1906; January 1, 1912, to September 30, 1916. May 26, 1903, to June 23, 1906, for station at the west outskirts of Belle Fourche. The records not directly comparable as Redwater River enters between the two stations and water is diverted from Belle Fourche River.

Gages.—Inclined staff 100 feet from crest of diversion dam and a gage in canal. See "Computation of discharge."

Computation of discharge.—The following information was supplied by the United States Reclamation Service:

The records of daily discharge represent the entire flow of the river at the diversion dam and have been corrected for water diverted through Inlet canal and passed through the sluice gates. The diversion dam acts as a weir. The crest is 400 feet long. The gage is about 100 feet from the crest and is read twice daily. Careful discharge measurements were made in the river above and below the dam before the coefficient was derived, and the discharge rating table as originally computed has not been changed. The quantity diverted is determined at a gaging station maintained on Inlet canal, and the rating curve is checked by frequent discharge measurements. The sluice gates are seldom used and the flow through them is estimated.

Diversions.—In that part of the drainage area in Wyoming there were, prior to July 1, 1914, adjudicated diversions of 25 second-feet from Belle Fourche River, and 237 second-feet from tributaries. In South Dakota there are authorized diversions of 102 second-feet from Belle Fourche River above the gaging station and approximately 2,500 second-feet from tributaries. Below the station there are authorized diversions of 3,102 second-feet from Belle Fourche River.

Accuracy.—The United States Reclamation Service considers the records "fair."

Cooperation.—Station maintained and record of daily discharge furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	1,060	430	240	412	412	780	580	620	1,000	570	617	135
	820	240	395	412	412	780	638	600	820	520	985	135
	820	240	550	412	412	525	638	572	770	485	460	135
	745	240	550	412	412	525	638	566	785	485	480	135
	745	240	550	412	412	525	638	566	795	325	280	135
	745	240	550	412	412	525	638	522	715	140	247	135
	745	240	550	412	412	525	638	498	715	140	297	135
	745	240	550	412	412	1,720	638	445	690	140	182	135
	745	240	550	412	412	1,290	525	445	630	100	182	135
	745	240	550	412	412	1,290	638	635	740	160	182	135
	685	240	550	412	412	1,290	638	530	660	347	182	135
	625	240	550	412	412	1,290	638	585	620	178	394	135
	625	240	550	412	412	1,290	638	623	615	130	262	100
	625	240	550	412	412	1,090	710	945	615	83	250	167
	625	240	550	412	525	780	710	1,720	615	83	250	143
	625	240	550	412	1,120	525	710	940	560	100	198	143
	625	240	550	412	1,290	525	710	710	560	100	170	143
	625	240	550	412	1,290	525	638	638	560	1,240	182	143
	625	240	550	412	2,460	525	780	710	650	755	132	143
	625	240	550	412	2,670	525	780	865	1,060	195	180	143
	625	240	550	412	2,440	525	780	1,190	1,610	195	397	143
	625	240	550	412	2,040	525	740	1,600	1,330	195	377	135
	625	240	550	412	2,040	525	780	1,680	950	190	327	177
	625	240	550	412	1,290	525	780	1,540	1,180	130	274	177
	625	240	550	412	1,290	525	780	1,370	1,600	110	229	177
	625	240	550	412	1,290	525	780	1,130	2,170	110	187	177
	625	240	550	412	940	525	710	1,060	1,380	90	187	177
	625	240	550	412	780	525	638	970	1,060	140	187	177
	625	240	550	412	780	525	638	930	900	740	187	177
	625	240	550	412	....	580	638	780	675	330	187	177
	625	....	550	412	....	580	....	780	....	195	199	....

NOTE.—Records as furnished have been changed slightly to conform to computing rules of United States Geological Survey. Records show combined flow of river and canal at diversion dam.

Monthly discharge of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,060	625	681	41,900
November	430	240	246	14,600
December	550	240	535	32,900
January	412	412	412	25,300
February	2,670	412	966	55,600
March	1,720	525	733	45,100
April	780	525	681	40,500
May	1,720	445	863	53,100
June	2,170	560	898	53,400
July	1,240	83	279	17,200
August	985	132	284	17,500
September	177	100	148	8,810
The year	2,170	83	559	405,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey.

WHITE RIVER BASIN.

WHITE RIVER NEAR INTERIOR, S. DAK.

LOCATION.—Near southwest corner of sec. 7, T. 4 S., R. 18 E., at steel highway bridge on Pine Ridge Indian Reservation, 3 miles southwest of Interior, Stanley County.

DRAINAGE AREA.—4,090 square miles; area at old site 15 square miles less.

RECORDS AVAILABLE.—August 24, 1911, to September 30, 1916; June 24, 1904, to November 30, 1906 at station near southwest corner sec. 10, T. 4 S., R. 18 E.

GAGE.—Vertical staff, attached to downstream side of first pier at left end of brid read since August 31, 1911; temporary gage at same datum installed August 24 a tree on left bank near southwest corner NW. ¼ sec. 17. Other gages used 190 1906 are described in Water Supply Papers 130 (p. 181), 172 (p. 166) and 2 (p. 135). Gage read by George Carlbom.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Control shifts occasionally. Bed composed of sand a some quicksand. Left bank steep and clean; right bank steeply sloping; clea

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.1 feet May 2 1916 (discharge, 7,800 second-feet); minimum stage recorded, 3.42 feet Septe ber 13, 1916 (discharge, 24 second-feet).

1904–1906 and 1911–1916: Maximum stage recorded, 15.1 feet July 4, 1905 (d charge, 14,900 second-feet); river reported dry August 27–28, 1905 and July 13–1 19–29, September 26–30, 1914.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued duri the winter.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used October to November 13, fairly well defined; curve used March 15 to September 30, w defined below 300 second-feet. Gage read twice daily to half-tenths. Dischar ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of White River near Interior, S. Dak., during the year endi Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Dis charg
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-*
Nov. 2	V. H. Sprague	3.99	89	Aug. 27	E. F. Chandler	3.58	
Apr. 24	.....do	3.96	124	Sept. 17	.....do	3.44	
June 6	.....do	4.18	202				

Daily discharge, in second-feet, of White River near Interior, S. Dak., for the year endi Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1	1,020	90	....	137	108	210	229	174	
2	828	81	....	147	167	210	174	157	
3	462	78	....	309	203	248	157	615	
4	225	75	....	394	167	330	108	210	
5	170	75	....	229	137	288	137	147	
6	129	75	....	181	108	188	174	114	
7	117	105	....	154	124	288	510	108	
8	111	111	....	256	81	225	309	86	
9	111	99	....	256	81	188	124	134	
10	111	90	....	233	77	174	103	228	
11	108	81	....	214	81	560	114	157	
12	105	78	....	188	81	860	309	103	
13	105	75	....	167	86	925	229	59	
14	105	....	....	124	192	762	114	77	
15	102	....	206	114	2,120	795	86	70	
16	640	....	196	108	958	642	439	50	
17	1,100	....	192	121	394	439	1,820	50	
18	435	....	192	108	210	288	700	42	
19	265	....	170	134	147	210	210	63	
20	188	....	196	178	140	203	157	330	
21	152	....	210	127	5,320	462	94	762	
22	138	....	233	124	4,750	462	94	288	
23	135	....	268	108	2,240	486	167	167	
24	105	....	214	108	2,920	958	192	108	
25	135	....	181	108	1,880	1,100	124	59	
26	132	....	160	108	1,360	1,200	94	42	
27	120	....	147	108	990	860	81	40	
28	108	....	137	108	560	330	35	59	
29	99	....	114	94	486	248	30	59	
30	90	....	111	137	330	462	860	59	
31	90	....	81	....	268	....	372	36	....

Monthly discharge of White River near Interior, S. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,100	90	250	15,400
November 1–13	111	75	85.6	2,210
March 15–31	268	84	177	5,970
April	394	94	163	9.700
May	5,320	77	863	53,100
June	1,200	174	487	29,000
July	1,820	30	269	16,500
August	762	36	150	9,220
September	42	24	29.0	1,730

WHITE RIVER NEAR WESTOVER, S. DAK.

Location.—In sec. 33, T. 3 S., R. 29 E., on Rosebud Indian Reservation, at steel highway bridge 2 miles below entrance of South Fork, 12 miles south of Murdo a station on Chicago, Milwaukee & St. Paul Railway about 2 miles from Westover in Lyman County.

Records available.—August 25, 1911, to September 30, 1916.

Drainage area.—7,850 square miles.

Gage.—Chain gage on highway bridge read since April 8, 1912. Prior to that date a vertical staff in several sections, located about 40 rods downstream; datum 2.0 feet lower than that of present gage. An auxiliary staff gage fastened to downstream face of left abutment, at same datum as chain gage, has been read occasionally by observer since August 18, 1913. Gage read by J. E. Rawhauser to April 30, 1916, and by E. F. Sterner since that date.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed composed of sand and firm gravel; shifts.

Extremes of discharge.—Maximum stage recorded during year, 10.6 feet May 26, 1916 (discharge, 7,700 second-feet); minimum stage recorded, 6.2 feet September 20 (discharge 80 second-feet).

1911–1916: Maximum stage recorded, 10.6 feet May 26, 1916 (discharge, 7,700 second-feet); minimum stage recorded, 5.3 feet November 11, 1912 (discharge, 4 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; flow not computed.

Accuracy.—Stage-discharge relation not permanent. Gage read once daily to half tenths. Discharge ascertained by shifting-control method except November 8 to December 15, for which it was determined from observer's notes and weather records. Records fair.

Discharge measurements of White River near Westover, S. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	V. H. Sprague	6.98	319	Aug. 26	E. F. Chandler	7.04	294
Apr. 24	do	6.93	433	Sept. 16	do	6.37	93
June 5	do	7.29	561				

Daily discharge, in second-feet, of White River near Westover, S. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,750	335	185	....	1,070	335	335	1,010	570	335	140
2	1,610	335	185	....	940	385	290	790	470	840	140
3	1,200	335	185	....	810	385	290	535	385	610	132
4	1,200	335	185	....	690	385	250	535	335	412	117
5	1,200	335	160	....	570	440	290	535	270	335	100
6	740	335	160	....	570	470	335	470	250	250	110
7	610	290	160	....	650	535	290	470	250	335	105
8	412	290	160	....	740	535	290	470	215	312	105
9	412	290	160	....	740	535	250	412	270	250	95
10	360	290	140	....	740	535	250	470	570	215	95
11	360	290	140	....	790	535	250	570	360	172	100
12	312	290	140	....	1,010	470	250	950	290	172	93
13	312	290	125	....	895	470	250	2,650	290	172	90
14	312	215	110	....	895	470	290	2,300	215	150	90
15	312	215	100	....	790	412	385	1,680	200	140	90
16	312	215	....	2,660	740	440	3,110	1,400	250	132	90
17	535	215	....	3,110	740	385	2,140	950	2,560	172	90
18	2,740	215	....	5,220	650	385	1,330	1,330	385	172	90
19	1,900	215	....	3,530	570	335	650	1,900	2,060	172	90
20	1,900	215	....	3,110	570	335	570	1,070	1,330	150	80
21	1,610	215	....	5,220	500	335	570	950	695	150	82
22	1,200	215	....	4,260	500	335	5,060	1,260	440	610	90
23	650	215	....	3,310	500	385	3,650	950	335	950	90
24	440	215	....	1,750	500	385	5,060	1,070	270	695	90
25	440	215	....	1,470	385	385	7,030	1,260	232	385	85
26	440	185	....	1,330	385	335	5,060	1,540	215	270	95
27	385	185	....	1,070	385	335	3,210	1,680	360	232	95
28	385	185	....	1,070	385	335	2,390	1,610	215	200	103
29	335	185	....	1,070	385	335	1,610	1,610	232	172	103
30	335	185	....	....	335	335	1,260	1,200	232	160	103
31	335	....	....	....	335	....	1,180	....	200	150	....

Monthly discharge of White River near Westover, S. Dak., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,740	312	808	49,700
November	335	185	252	15,000
December 1-15	185	100	153	4,550
February 16-29	5,220	1,070	2,730	75,800
March	1,070	335	638	39,200
April	535	335	409	24,300
May	7,030	250	1,550	95,300
June	2,650	412	1,120	66,600
July	2,560	200	482	29,600
August	950	132	306	18,800
September	140	80	99.3	5,910

SOUTH FORK OF WHITE RIVER[1] NEAR WESTOVER, S. DAK.

Location.—At southwest corner of SE. ¼ sec. 10, T. 43 N., R. 28 W., at C. H. Kendall's ranch, on Rosebud Indian Reservation, 2 miles above mouth and about 4 miles south of Westover, in Mellette County.

Drainage area.—1,590 square miles.

Records available.—June 26, 1912, to September 30, 1916.

Gage.—Overhanging chain gage on right bank, 6 rods below cable. Prior to September 18, 1913, a staff gage 10 rods below cable was read during the year. In 1912 a staff gage 30 rods below cable was read. All gages referred to same datum.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of gravel and sand; shifts occasionally.

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[1] Formerly called Little White River.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.3 feet, February 17, 1916 (stage discharge relation seriously affected by ice); minimum stage, 1.40 feet March 2 and 3.

1912–1916: Maximum stage recorded, 2.75 feet, April 7, 1915 (discharge, 2,780 second-feet); minimum stage recorded, 1.95 feet, October 21, 1914 (discharge, 20 second-feet). Records cover open-water season only.

ICE.—Stage-discharge relation seriously affected by ice; no readings December 16, 1915, to February 15, 1916.

Data insufficient to warrant publication of discharge records.

Discharge measurements of South Fork of White River near Westover, S. Dak., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
1	V. H. Sprague	2.29	141	Aug. 26	E. F. Chandler	2.03	70
25	do	2.00	225	Sept. 16	do	2.01	65
5	do	2.02	233				

Daily gage height, in feet, South Fork of White River near Westover, S. Dak., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	2.03	2.29	2.1	....	1.45	1.8	2.0	2.6	2.2	2.0	2.0
	2.03	2.29	2.1	....	1.4	1.8	2.0	2.5	....	....	2.05
	2.3	2.25	2.1	....	1.4	1.9	2.0	2.2	2.05	2.0	....
	2.3	2.25	2.1	....	1.75	1.9	2.0	2.1	2.02	2.0	2.02
	2.3	2.25	....	....	2.0	1.95	1.98	2.02	2.0	2.0	2.0
	2.25	2.3	2.1	....	2.3	....	1.98	2.0	2.0	....	2.0
	2.25	2.3	2.1	....	2.95	1.95	....	2.0	2.0	1.95	2.0
	....	2.27	2.1	....	....	2.0	1.95	2.0	2.0	1.95	2.0
	2.25	2.27	2.1	....	2.2	....	2.0	2.0	2.0	....	2.0
	2.3	2.26	2.1	....	2.2	2.0	2.0	2.1	2.0	1.9	....
	2.31	2.25	2.1	....	1.65	2.0	2.0	2.3	....	1.9	1.9
	2.3	2.2	2.2	....	....	2.0	....	2.1	1.95	1.9	1.9
	2.3	2.2	2.3	....	1.65	2.0	2.0	2.0	1.95	....	....
	2.3	....	2.4	....	1.6	2.0	2.05	2.4	1.95	1.9	1.9
	2.28	2.2	4.0	....	1.6	2.05	2.1	....	1.95	1.9	1.9
	2.3	2.2	....	6.2	1.55	....	2.1	2.0	2.4	1.95	1.9
	....	2.2	....	7.3	1.5	2.0	2.0	2.0	2.2	1.95	....
	2.3	2.5	....	5.5	1.5	2.0	2.0	....	2.1	....	1.95
	2.3	2.5	....	4.6	....	2.05	2.6	2.0	2.1	1.9	2.0
	2.3	2.5	....	4.0	1.6	2.0	2.2	2.05	2.0	2.9	2.0
	2.3	2.4	....	4.0	1.55	2.0	....	2.1	....	2.5	2.0
	2.3	2.4	....	4.0	1.55	1.95	2.1	2.2	1.95	2.3	2.0
	2.3	2.3	....	3.4	1.6	....	2.1	2.1	1.9	....	2.0
	2.3	....	....	3.0	1.6	2.0	3.0	2.0	1.95	2.0	2.0
	2.3	2.2	....	2.8	1.55	2.0	2.2	....	1.95	2.0	2.0
	2.3	2.2	....	2.65	1.55	2.0	2.2	2.5	1.9	2.0	2.0
	....	2.2	....	....	....	2.0	2.4	2.3	1.9	....	2.0
	2.3	2.1	....	2.4	1.65	2.0	2.2	2.25	1.95	2.0	....
	2.28	2.1	....	2.0	1.65	2.0	2.2	2.2	1.95	2.0	2.02
	2.28	2.13	....	....	1.7	....	....	2.2	2.05	2.0	2.0
	....	....	....	....	1.8	....	2.2	....	2.0	2.0	....

PLATTE RIVER BASIN.

NORTH PLATTE RIVER NEAR NORTHGATE, COLO.

LOCATION.—In sec. 11, T. 11 N., R. 80 W., at highway bridge on Interstate highway, 6 miles south of Colorado-Wyoming line and 6 miles northwest of Northgate, in Jackson County. Three small tributaries—Camp, Threemile, and Sixmile creeks—enter North Platte River between station and State line. These streams have very little flow except spring run-off.

DRAINAGE AREA.—1,440 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 23, 1915, to September 30, 1916.

Gage.—Vertical staff at downstream side of center pier of bridge; read by Mrs. H. L McCasland.

Discharge measurements.—Made from two-span bridge or by wading.

Channel and control.—Bed composed of sand, gravel, and small boulders. Control 200 feet downstream at small rapids, which shift slightly. Banks not subjec to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.7 feet, at 5 p. m June 19 (discharge, approximately 2,100 second-feet); minimum discharge occur during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinue during winter.

Diversions.—There are court decrees for diversion of 3,060 second-feet from th North Platte and tributaries in Colorado. During 1916 Michigan ditch diverted 6,500 acre-feet from a tributary of the North Platte to the Cache la Poudre drainage

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent but shifting between very narrow limits. Rating curve well defined between 200 and 1,600 second-feet. Gag read to quarter tenths twice daily. Daily discharge ascertained by applyin mean daily gage height to rating table. Records excellent.

Discharge measurements of North Platte River near Northgate, Colo., during the yea ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 13	H. K. Smith	3.23	1,52
June 10	R. H. Fletcher	3.09	1,38
Aug. 15	H. K. Smith	2.26	54

Daily discharge, in second-feet, of North Platte near Northgate, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	179	160	....	1,200	1,100	1,040	719	381
2	164	156	....	995	1,150	995	678	32
3	164	152	....	1,040	1,100	945	678	27
4	164	160	....	850	1,100	898	678	26
5	206	160	....	898	1,200	805	719	25
6	216	160	....	1,040	1,260	719	760	24
7	206	152	....	1,260	1,320	719	898	25
8	179	179	....	1,380	1,200	678	898	241
9	175	197	....	1,620	1,200	678	850	22
10	179	183	640	1,860	1,380	760	850	35
11	175	197	898	1,980	1,620	898	850	53
12	206	221	1,040	1,740	1,860	760	850	53
13	221	....	995	1,440	1,740	640	898	46
14	206	....	805	1,500	1,860	602	898	40
15	221	....	760	1,500	1,860	602	532	32
16	257	....	850	1,320	1,860	678	500	32
17	326	....	898	1,200	1,860	602	500	29
18	320	....	945	1,040	1,980	602	468	27
19	262	....	1,040	898	1,980	602	408	26
20	246	....	898	898	1,980	567	381	25
21	225	....	678	1,200	1,860	532	352	24
22	211	....	640	1,440	1,740	500	352	241
23	201	....	760	1,500	1,380	468	324	24
24	197	....	945	1,150	1,150	438	298	26
25	187	....	1,150	805	1,150	381	288	28
26	179	....	1,320	805	1,150	408	298	28
27	175	....	1,500	898	1,150	468	293	28
28	179	....	1,740	805	1,150	532	298	28
29	171	....	1,740	898	1,150	602	293	28
30	175	....	1,740	945	1,100	678	298	28
31	168	....	....	1,040	....	719	352	....

Note.—Shifting-control method used Oct. 1 to Nov. 12.

Monthly discharge of North Platte River near Northgate, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
[illegible]	326	164	205	12,600
er 1-12	221	152	173	4,120
30	1,740	640	1,050	43,700
[illegible]	1,980	805	1,200	73,800
[illegible]	1,980	1,100	1,450	86,300
[illegible]	1,040	381	662	40,700
[illegible]	898	293	563	34,600
ber	532	241	307	18,300

NORTH PLATTE RIVER AT SARATOGA, WYO.

LOCATION.—At highway bridge at Saratoga, in Carbon County. Nearest tributary, Spring Creek, enters 2 miles above.

DRAINAGE AREA.—2,880 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—June 9, 1903, to October 31, 1906; April 1 to December 17, 1909; April 27, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain gage on upstream side of bridge; read by Miss Nora Doggett. Gage prior to 1911 was vertical staff 100 yards below bridge. Relation between datum of gages not determined.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge or by wading near control.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control at rapids 500 feet downstream; fairly permanent. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.3 feet at 7:45 a. m. May 10 (discharge, 6,060 second-feet); minimum discharge during winter months estimated at 192 second-feet January 12 and 17.

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 83 second-feet from the North Platte, between Saratoga and State line, and 934 second-feet from tributaries entering above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent, but shifts between very narrow limits. Rating curve used before February 20 well defined; curve used after February 20 well defined between 160 and 6,600 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent, except those for winter period, which are fair.

Discharge measurements of North Platte River at Saratoga, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
6	R. H. Fletcher	4.08	438	May 11	H. K. Smith	7.08	5,360
6	R. I. Meeker	[a]4.40	240	June 8	R. H. Fletcher	6.61	4,350
26	do	[a]4.12	259	Aug. 12	H. K. Smith	4.72	886
[illegible]	R. H. Fletcher	3.95	313				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Platte River at Saratoga, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	455	365	407	238	310	300	870	2,690	4,490	2,500	870	650
2	425	335	371	238	310	345	920	2,500	4,240	2,310	870	610
3	395	335	371	238	310	300	920	2,220	3,990	2,130	920	540
4	395	265	395	238	310	315	870	2,220	4,490	1,950	920	505
5	455	335	413	238	310	310	920	2,500	4,740	1,780	920	540
6	455	335	401	238	310	540	690	3,300	4,740	1,620	1,080	440
7	455	335	419	238	310	470	650	3,990	4,240	1,470	1,080	440
8	443	413	407	238	310	470	575	4,490	4,240	1,330	1,080	440
9	419	407	379	210	310	398	470	5,260	4,490	1,260	970	440
10	413	455	413	210	310	505	610	5,790	5,000	1,330	970	540
11	431	437	347	210	310	575	970	5,260	5,790	1,470	920	575
12	455	359	335	192	310	575	1,330	5,000	5,790	1,540	825	690
13	455	305	347	210	310	690	1,470	4,740	5,790	1,260	825	690
14	488	285	353	245	310	650	1,400	4,240	5,260	1,140	870	610
15	455	242	365	245	310	610	1,400	3,750	5,520	1,140	825	540
16	520	371	335	228	310	610	1,470	3,300	5,000	1,080	780	505
17	520	353	245	192	310	650	1,330	2,890	5,260	970	780	470
18	555	419	238	210	310	870	1,470	2,690	5,260	970	735	440
19	555	431	245	228	310	970	1,620	2,500	5,520	970	650	410
20	520	431	310	245	310	1,700	1,700	2,890	5,790	1,020	610	410
21	520	425	365	245	320	2,890	1,400	3,750	4,740	870	540	410
22	520	455	365	245	340	2,500	1,200	3,750	4,490	735	540	410
23	520	449	320	265	345	2,500	1,400	3,520	3,750	690	470	410
24	520	488	285	265	345	2,310	1,700	3,300	3,300	650	380	410
25	488	395	245	265	330	1,540	2,040	3,300	2,890	650	356	650
26	431	455	245	265	315	1,330	2,500	3,090	2,890	650	380	610
27	413	455	285	265	350	1,330	2,890	2,890	2,890	575	410	575
28	425	413	245	265	300	1,200	3,300	3,300	2,690	690	380	540
29	407	347	238	285	340	1,400	3,750	3,520	2,690	735	440	470
30	407	379	238	285	....	1,260	3,300	3,750	2,690	920	470	470
31	407	....	238	285	....	970	....	4,240	....	920	690	....

NOTE.—Stage-discharge relation affected by ice Dec. 12, 13, 16–19, and Dec. 25 to Feb. 20; discharge record based on daily gage heights, discharge measurements, observer's notes, and weather records.

Monthly discharge of North Platte River at Saratoga, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	555	395	462	28,400
November	488	242	382	22,700
December	419	238	328	20,200
January	285	192	241	14,800
February	350	300	317	18,200
March	2,890	300	1,000	61,500
April	3,750	470	1,500	89,300
May	5,790	2,220	3,570	220,000
June	5,790	2,690	4,422	263,000
July	2,500	575	1,200	73,800
August	1,080	356	728	44,800
September	690	410	515	30,600
The year	5,790	192	1,220	887,000

NORTH PLATTE RIVER ABOVE PATHFINDER, WYO.

LOCATION.—In sec. 27, T. 26 N., R. 84 W., 900 feet below mouth of Lost Creek and three-quarters of a mile below mouth of Black Canyon, in Carbon County. Backwater from Pathfinder reservoir reaches within 2½ miles of station.

DRAINAGE AREA.—7,410 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—October 7, 1913, to September 30, 1916.

GAGE.—Friez water-stage recorder on right bank 900 feet below Lost Creek.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Bed composed of small boulders. Gage at lower end of pool 600 feet long. Control at the rapids; practically permanent. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.97 feet from 6 to 9 a. m. June 14 (discharge, 6,360 second-feet); minimum discharge occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 84 second-feet from North Platte River between Saratoga and the station above Pathfinder and diversions of 1,270 second-feet from intervening tributaries.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 400 and 6,500 second-feet. Operation of water-stage recorder satisfactory except for short periods as shown by footnote to daily-discharge table. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph. Records excellent.

Discharge measurements of North Platte River above Pathfinder, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
15	R. H. Fletcher	1.18	541	June 20	H. K. Smith	3.80	5,960
12	do	3.80	5,880	Aug. 12	W. R. King	1.70	1,050
25	do	3.18	3,850				

Daily discharge, in second-feet, of North Platte River above Pathfinder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	820	487	566		1,680	3,800	4,380	2,560	1,120	954
	750	494	558		1,600	3,180	4,770	2,440	1,200	942
	702	487	582		1,540	2,840	4,770	2,280	1,300	740
	657	473	622		1,470	2,620	4,800	2,190	1,400	639
	606	466	590		1,440	2,620	4,870	2,040	1,480	582
	566	466	529		1,440	2,950	5,200	1,880	1,550	590
	543	466	536		1,410	3,420	5,200	1,730	1,600	543
	529	466	515		1,310	4,320	5,040	1,650	1,500	508
	522	480	501		1,210	5,040	4,770	1,650	1,350	501
	515	515	515		1,080	5,710	4,740	1,580	1,200	648
	515	480	501	1,210	1,180	6,060	5,370	1,620	1,100	614
	515	487	508	1,350	1,470	5,880	5,880	1,580	1,050	740
	515	265	424	1,490	1,730	5,710	6,060	1,600	1,030	684
	522	350	445	1,630	2,060	5,370	6,230	1,520	920	740
	550	392	466	1,780	2,110	5,040	5,880	1,360	860	720
	598	338	473	1,930	1,990	4,540	5,880	1,260	910	648
	614	386	431	1,540	1,950	4,170	5,710	1,210	910	590
	648	522		1,500	2,000	3,800	5,710	1,180	830	543
	657	536		1,700	2,080	3,470	5,710	1,130	770	508
	684	536		2,090	2,240	3,370	5,710	1,080	720	480
	693	590		3,020	2,320	3,400	5,540	1,050	1,080	466
	675	657		3,940	2,130	3,890	5,040	1,030	730	452
	648	590		3,860	1,880	4,060	4,770	970	630	431
	630	675		3,250	1,850	4,140	4,080	920	590	459
	606	558		3,230	2,130	3,890	3,620	875	536	473
	598	494		2,750	2,560	3,750	3,250	820	494	550
	582	338		2,170	2,950	3,600	2,970	800	466	693
	536	344		1,930	3,420	3,420	2,840	770	445	657
	529	693		1,900	3,860	3,500	2,730	770	438	598
	515	529		1,950	4,110	3,620	2,600	950	480	566
	501			2,000		3,860		1,000	1,120	

NOTE.—Discharge Mar. 12-15, Apr. 11, 12, 27, 28, May 1-5, July 30 to Aug. 4, and Aug. 6-11 estimated by comparison with records of discharge at Saratoga.

Monthly discharge of North Platte River above Pathfinder, Wyo., for the year endin Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet)
	Maximum.	Minimum.	Mean.	
October	820	501	598	36,80
November	693	265	485	28,90
December 1-17	622	424	515	17,40
March 11-31	3,940	1,210	2,200	91,60
April	4,110	1,080	2,010	120,00
May	6,060	2,620	4,030	248,00
June	6,230	2,600	4,800	286,00
July	2,560	770	1,400	86,10
August	1,600	438	962	59,20
September	954	431	609	36,20

NORTH PLATTE RIVER AT PATHFINDER, WYO.

Location.—In sec. 24, T. 29 N., R. 84 W., one-quarter mile below Pathfinder dam and one-third mile below old post office of Pathfinder, in Natrona County. Nearest tributary, Canyon Creek, enters 2 miles above, in the reservoir.

Drainage area.—10,700 square miles (measured on base map of Wyoming; scale 1:500,000).

Records available.—May 9, 1905, to September 30, 1916.

Gage.—Chain gage on left bank one-fourth mile below Pathfinder dam; read by J. C. Austin.

Discharge measurements.—Made from cable 50 feet upstream from gage.

Channel and control.—No information.

Extremes of discharge.—No data.

Winter flow.—Stage-discharge relation not seriously affected by ice.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 371 second-feet from tributaries entering the North Platte between the station above Pathfinder and this station. Near Whalen, 150 miles below, the water from Pathfinder reservoir is diverted by the Interstate Canal and used to irrigate land in Nebraska and Wyoming.

Regulation.—The Pathfinder Dam forms a reservoir 1,025,000 acre-feet in capacity and materially changes the natural run-off of the river.

Cooperation.—Records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of North Platte River at Pathfinder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5	5	5	10	10	10	10	1,000	4,300	5,020	4,550	2,120
2	5	5	5	10	10	10	10	1,900	4,340	4,980	4,460	2,750
3	5	5	5	10	10	10	10	2,000	3,330	5,020	4,570	2,970
4	5	5	5	10	10	10	10	2,000	4,490	5,340	4,430	2,540
5	5	5	5	10	10	10	10	2,000	4,300	5,410	4,350	2,200
6	5	5	5	10	10	10	10	2,000	4,300	5,410	4,600	2,170
7	5	5	5	10	10	10	10	2,000	4,300	5,410	4,800	2,260
8	5	5	5	10	10	10	10	2,030	4,300	5,410	4,560	2,370
9	5	5	5	10	10	10	10	2,060	4,350	5,700	4,720	2,260
10	5	5	5	10	10	10	10	2,440	4,300	5,720	4,600	2,200
11	5	5	5	10	10	10	10	2,420	4,880	5,720	4,860	2,200
12	5	5	5	10	10	10	10	3,090	5,020	5,720	4,430	2,200
13	5	5	5	10	10	10	10	2,910	5,060	5,490	4,600	1,790
14	5	5	5	10	10	10	10	4,260	5,640	5,410	4,600	1,640
15	5	5	5	10	10	10	10	4,260	5,120	5,460	4,010	1,900
16	5	5	5	10	10	10	10	4,260	5,020	5,470	3,400	2,020
17	5	5	5	10	10	10	10	4,260	5,020	5,470	3,460	1,900
18	5	5	5	10	10	10	10	4,140	5,020	5,450	3,580	1.840
19	5	5	5	10	10	10	10	3,780	5,020	5,470	3,660	1,660
20	5	5	5	10	10	10	10	4,340	5,020	4,790	3,370	1,760
21	5	5	5	10	10	10	10	4,340	4,990	4,550	3,350	1,850
22	5	5	5	10	10	10	10	4,340	4,360	4,520	3,320	1,660
23	5	5	5	10	10	10	10	4,560	3,610	4,640	3,660	1,620
24	5	5	5	10	10	10	10	4,300	4,060	4,430	3,360	1,090
25	5	5	5	10	10	10	10	4,300	4,060	4,470	3,400	1,660
26	5	5	5	10	10	10	690	4,300	4,060	4,470	3,300	1,660
27	5	5	5	10	10	10	1,000	4,300	4,780	4,290	3,300	1,760
28	5	5	5	10	10	10	1,000	4,300	5,020	3,970	3,140	1,760
29	5	5	5	10	10	10	1,000	4,300	5,060	4,020	3,200	1,200
30	5	5	5	10	....	10	1,000	4,300	5,060	3,950	2,140	750
31	90	....	5	10	....	150	....	4,220	....	3,910	2,060	....

Monthly discharge of North Platte River at Pathfinder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	90	5	7.7	474
November	5	5	5	298
December	5	5	5	307
January	10	10	10	615
February	10	10	10	575
March	150	10	14.5	892
April	1,000	10	165	9,820
May	4,560	1,000	3,380	208,000
June	5,640	3,330	4,610	274,000
July	5,720	3,910	5,000	307,000
August	4,860	2,060	3,870	238,000
September	2,970	750	1,950	116,000
The year	5,720	5	1,590	1,160,000

NOTE.—Figures changed slightly to conform to computation rules of United States Geological Survey.

NORTH PLATTE RIVER AND INTERSTATE CANAL AT WHALEN, WYO.

LOCATION.—In sec. 11, T. 26 N., R. 65 W., at head of Interstate canal at Whalen, in Goshen County. Nearest important tributary is Cottonwood Canyon Creek, an intermittent stream which enters 1½ miles below.

DRAINAGE AREA.—16,300 square miles (measured on base map of Wyoming; scale 1: 500,000).

Records available.—May 1, 1909, to September 30, 1916. Records represent th discharge passing the overfall weir at Whalen and also that passing the head gate of canal, which are just above Whalen weir.

Gage.—Vertical staff, zero at weir crest, is used to determine the flow over the weir discharge being computed by a weir formula; flow through the four sluice gate in the dam, also computed. In the river, 75 feet downstream from the weir gag is a second gage, zero of which is 10 feet below that of the weir gage; second gag is used only in computing the discharge through the gates when the openings ar submerged. Discharge through the head gates of the canal is computed from th nine gate openings. A vertical staff in the canal, 1,000 feet below the head gates is used in computing the discharge when the head gate openings are submerged.

Discharge measurements.—Made from cable 1 mile below weir, in order to chec the coefficients used in the discharge computations.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions fro North Platte River of 88 second-feet between the Pathfinder reservoir and th gaging station at Whalen, exclusive of the diversion by United States Reclamation Service. Between Whalen and the State line there are adjudicated diversions of 240 second-feet.

Regulation.—Records show chiefly the effect of the Pathfinder reservoir, which stores water for use in the Interstate canal.

Cooperation.—Records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of North Platte River and Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1....	2,560	475	357	151	101	169	822	1,990	4,470	4,410	4,030	2,840
2....	1,970	465	274	169	98	150	703	2,040	4,290	4,460	3,920	2,360
3....	1,360	448	280	187	100	167	725	1,920	4,370	4,460	4,290	2,260
4....	1,100	448	430	184	100	214	775	1,910	4,280	4,540	4,280	2,470
5....	957	440	442	209	103	349	972	2,620	3,690	4,520	4,440	2,800
6....	890	448	450	192	103	335	820	2,610	4,250	4,770	4,320	2,750
7....	835	455	495	187	104	488	804	2,570	4,150	4,770	4,530	2,480
8....	798	425	520	185	109	230	758	2,670	4,150	4,780	4,600	2,190
9....	683	418	416	191	109	229	673	2,700	4,050	4,900	4,720	2,090
10....	650	408	423	196	111	231	690	2,690	4,050	4,900	4,430	2,130
11....	640	430	565	204	124	390	658	2,720	4,060	5,160	4,600	2,120
12....	605	425	450	156	143	337	703	2,810	4,060	5,250	4,520	2,070
13....	585	385	390	126	162	288	959	3,040	4,600	5,580	4,680	2,060
14....	565	370	215	130	205	300	1,360	3,490	4,680	4,850	4,600	1,860
15....	560	385	215	131	271	378	1,410	3,520	4,630	5,080	4,640	2,240
16....	590	365	94	121	285	444	1,400	4,400	5,130	5,120	4,520	1,810
17....	600	350	138	104	325	490	1,380	4,440	4,640	5,150	3,960	1,670
18....	800	410	61	108	397	462	1,500	4,460	4,640	5,120	3,600	1,990
19....	755	530	158	108	493	460	1,570	4,530	4,680	4,990	3,490	2,120
20....	765	445	147	110	491	378	1,570	4,430	4,740	4,940	3,470	2,020
21....	690	545	157	112	551	325	1,550	4,150	4,690	5,030	3,540	1,970
22....	665	470	197	106	602	430	1,550	4,690	4,640	4,520	3,420	1,760
23....	610	446	225	112	597	620	1,510	5,140	4,670	4,340	3,420	1,820
24....	590	390	230	122	756	690	1,550	5,110	4,060	4,860	3,370	1,930
25....	600	365	226	123	734	870	1,580	5,110	3,700	4,610	3,500	1,780
26....	562	451	214	124	668	884	1,500	4,860	3,900	4,510	3,540	1,690
27....	567	373	147	118	493	814	1,480	4,770	3,840	4,630	4,130	1,730
28....	520	382	135	110	285	612	1,390	4,700	3,840	4,950	3,400	1,800
29....	505	150	76	106	208	721	1,340	4,610	4,220	4,710	3,340	1,870
30....	500	275	92	99	....	744	1,780	4,600	4,410	4,590	3,240	1,730
31....	497	....	80	100	....	853	....	4,500	....	4,240	3,240	....

Monthly discharge of North Platte River and Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,560	497	792	48,700
November	545	150	412	24,500
December	565	61	268	16,500
January	209	99	141	8,670
February	756	98	304	17,500
March	884	150	453	27,900
April	1,780	658	1,180	70,200
May	5,140	1,910	3,670	226,000
June	5,130	3,690	4,320	257,000
July	5,580	4,240	4,800	295,000
August	4,720	3,240	3,990	245,000
September	2,840	1,670	2,080	124,000
The year	5,580	61	1,880	1,360,000

NOTE.—Quantities changed slightly to conform to computing rules of the United States Geological Survey.

Daily discharge, in second-feet, of Interstate canal, at Whalen, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
		672	1,250	1,440	1,330	1,210	17		1,280	1,120	1,540	1,500	1,140
		709	1,310	1,440	1,410	1,200	18		1,280	1,120	1,540	1,520	1,140
		684	1,280	1,440	1,450	1,200	19		1,280	1,120	1,540	1,520	1,140
		810	1,280	1,440	1,500	1,200	20		1,280	1,120	1,540	1,520	1,140
		850	1,280	1,440	1,500	1,200	21		1,100	1,140	1,540	1,530	1,140
		900	1,340	1,440	1,420	1,200	22		1,040	1,190	1,540	1,520	1,140
		955	1,350	1,440	1,490	1,200	23		1,040	1,240	1,540	1,520	1,150
		1,100	1,390	1,440	1,520	1,200	24		1,040	1,280	250	1,480	1,150
		1,160	1,390	1,450	1,540	1,200	25		1,040	1,300	0	1,420	1,150
		1,240	1,390	1,450	1,540	1,200	26	268	1,040	1,390	0	1,450	1,150
		1,330	1,400	1,450	1,540	1,200	27	528	1,040	1,400	380	1,430	1,150
		1,330	1,400	1,450	1,540	1,200	28	580	1,040	1,410	700	1,340	985
		1,340	1,150	1,450	1,540	1,200	29	592	1,100	1,420	975	1,340	808
		1,200	1,120	1,540	1,540	1,140	30	599	1,160	1,440	1,250	1,340	510
		1,150	1,120	1,540	1,540	1,140	31		1,230		1,280	1,280	
		1,280	1,120	1,540	1,540	1,140							

NOTE.—Head gates closed July 25, 26.

Monthly discharge of Interstate canal at Whalen, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	599	268	513	5,090
May	1,340	672	1,090	67,000
June	1,440	1,120	1,280	76,200
July	1,540	0	1,260	77,500
August	1,540	1,280	1,470	90,400
September	1,210	510	1,130	67,200
The period	1,540	0	1,220	383,000

NORTH PLATTE RIVER AT HENRY, NEBR.

LOCATION.—On west line of sec. 3, T. 23 N., R. 58 W., at highway bridge half a mile south of Henry post office, in Scotts Bluff County, within half a mile of Nebraska-Wyoming line. Nearest tributary, Spring Creek, enters just below.

DRAINAGE AREA.—22,100 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 11, 1912, to August 31, 1916.

Gage.—Three vertical staffs, one in each of the three channels. The datum of the first two gages is the same; that for the gage in third channel is 1 foot lower to avoid negative readings.

Discharge measurements.—Made from pile-bent bridge.

Channel and control.—Bed composed of shifting sand.

Extremes of discharge.—Maximum discharge recorded during the year, 4,600 second-feet on May 25; minimum discharge probably occurs during the winter months.

Ice.—Stage discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to September 1, 1914, there was an approved diversion of 209 second-feet from the North Platte between the Wyoming-Nebraska State line and this station. The Mitchell canal diverts water just beyond the State line to serve approximately 16,000 acres but has no approved diversions.

Regulation.—See North Platte at Pathfinder, Wyo.

Accuracy.—Stage-discharge relation not permanent; control very shifting. Standard rating curve, which was used indirectly, fairly well defined. Records fair.

Cooperation.—Daily discharge records furnished by State engineer of Nebraska.

Discharge measurements of North Platte River at Henry, Nebr., during the year ending Sept. 30, 1916.

Date.	Made by—	Discharge.	Date.	Made by—	Discharge.
		Sec.-ft.			*Sec.-ft.*
Apr. 22	D. P. Weeks, jr	1,450	July 9	L. E. Timbers	3,200
May 6	.....do	1,520	15	D. P. Weeks, jr	3,260
17	.....do	2,660	Aug. 1	...do	2,860
28	.....do	4,050	10	L. E. Timbers	3,290
June 7	.....do	2,560	17	D. P. Weeks, jr	2,810
11	L. E. Timbers	2,980	22	.....do	1,940
23	D. P. Weeks, jr	3,380	30	L. E. Timbers	2,010
25	L. E. Timbers	2,890	Sept. 2	.....do	2,050

Note.—Discharge is the sum of discharge in three separate channels and Spring Creek; record shows total flow of river.

Daily discharge, in second-feet, of North Platte River at Henry, Nebr., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	1,200	1,090	3,270	1,310	2,910	16	1.370	3,840	3,960	3,770	3,230
2	1,170	1,220	3,040	1,310	2,620	17	1,400	2,500	3,450	3,140	3,040
3	1,170	1,290	3.300	2,540	2,630	18	1,370	2,660	4,100	3,340	2,290
4	1,180	1,290	2,950	2,550	2,910	19	1,480	2,820	4,040	3,110	2,000
5	1,180	1,250	2,910	2,560	3,150	20	1,530	3,160	4,210	3,110	2,060
6	1,180	1,210	2,900	2,530	3,080	21	1,570	3,620	4,400	2,920	1,880
7	1,180	1,240	2,890	2,930	3,190	22	1,530	3,660	3,690	2,720	1,970
8	1,200	1,180	2,820	2,860	3,360	23	1,530	4,250	3,370	2,540	1,970
9	1,180	1,130	2,800	2,800	3.230	24	1,500	4,500	3,750	3,030	1,720
10	1,150	1,080	2,710	3,030	3,240	25	1,480	4,600	2,530	4,280	1,820
11	1,140	1,010	2,590	3,100	3,130	26	1,520	4,300	2,240	4,540	2,030
12	1,090	887	3,590	3,380	3,160	27	1,230	4,120	2,240	4,560	2,790
13	1,120	969	4,210	4,200	3,400	28	1,320	3,150	2,180	4,450	2,070
14	1,220	1,170	4,330	3,170	3,180	29	1,090	3,720	2,120	4,540	1,840
15	1,180	1,680	4,090	4,400	3,490	30	1,080	3,650	2,520	3,500	1,940
						31	....	3,450	....	2,890	1,860

Note.—Records reduced to three significant figures by United States Geological Survey.

Monthly discharge of North Platte River at Henry, Nebr., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	1,570	1,080	1,280	76,200
May	4,600	887	2,440	150,000
June	4,400	2,120	3,240	193,000
July	4,560	1,310	3,200	197,000
August	3,490	1,720	2,620	161,000
The period				777,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey.

DOUGLAS CREEK NEAR KEYSTONE, WYO.

Location.—In sec. 16, T. 14 N., R. 79 W., 900 feet above highway bridge and 1 mile above old mining camp at Keystone, in Albany County; 600 feet below site of proposed diversion dam of Bell supply canal No. 2. Nearest tributary, Keystone Creek, enters three-fourths mile below.

Drainage area.—26 square miles (measured on topographic map).

Records available.—July 25 to December 10, 1912; June 18, 1914, to November 12, 1916, when station was discontinued.

Gage.—Bristol water-stage recorder on left bank 900 feet above highway bridge on road from Keystone to Holmes. Gage was originally 60 feet farther downstream, but a new gage was installed at present site May 23, 1915. Although referred to same datum, the gage readings are now higher, owing to the slope of water surface of creek.

Discharge measurements.—Made from cable just above gage or by wading.

Channel and control.—Bed composed of cobble stones; permanent. No well defined control. Banks not subject to overflow.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.5 feet from 7 to 9 p. m. June 4 (discharge, 281 second-feet); minimum discharge occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—No diversion above station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 200 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of gage-height graph. Records good.

Cooperation.—Gage-height record furnished by Laramie Water Co. through C. C. Schrontz, general manager.

Discharge measurements of Douglas Creek near Keystone, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 14	Robert Follansbee	2.92	161
Aug. 18	H. K. Smith	1.50	5.6

Daily discharge, in second-feet, of Douglas Creek near Keystone, Wyo., for the period Oct. 1, 1915, to Nov. 12, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.								
1	10.	3.8	....	22	231	31	17.	9.5
2	8.0	3.8	....	29	221	32	14.	7.5
3	7.0	3.8	....	35	231	28	14.	7.0
4	7.0	3.8	....	37	241	28	20.	8.4
5	7.0	4.6	....	59	241	25	19.	9.1
6	7.5	4.2	....	124	221	25	18.	9.8
7	5.4	4.2	....	152	201	25	16.	11.
8	5.0	2.7	....	152	201	22	12.	11.
9	5.4	4.6	....	191	221	20	14.	12.
10	5.0	3.0	....	181	241	20	12.	12.
11	6.2	9.0	....	152	221	22	8.5	9.0
12	6.6	11.	....	142	211	20	10.	7.0
13	6.6	7.0	....	133	211	17	14.	7.0
14	7.0	....	....	116	181	14	16.	6.6
15	9.0	....	....	93	161	14	12.	5.8
16	5.8	....	....	90	152	14	12.	5.0
17	10.	....	....	78	142	14	12.	4.2
18	9.5	....	....	72	133	12	8.5	3.8
19	9.0	....	....	79	124	12	7.5	4.6
20	9.0	....	....	99	107	12	8.5	5.0
21	11.	....	....	107	93	12	9.0	5.0
22	14.	....	....	104	84	12	8.0	6.2
23	13.	....	4.2	94	73	9.5	7.5	7.5
24	10.	....	14.	142	61	9.5	7.0	14.
25	5.8	....	7.5	171	52	12	8.0	4.6
26	5.0	....	8.5	152	45	9.5	9.0	5.4
27	5.0	....	14.	152	42	9.5	8.5	6.2
28	5.0	....	16.	171	37	12	8.0	5.8
29	4.6	....	18.	181	34	17	9.0	5.0
30	4.2	....	24.	221	33	17	12.	4.6
31	4.2	....	....	231	....	14	13.	....

Day.	Oct.	Nov.	Day.	Oct.	Nov.	Day.	Oct.	Nov.
1916.			1916.			1916.		
1	5.4	5.8	11	7.0	4.2	21	7.5	....
2	6.2	5.0	12	6.6	5.0	22	7.5	....
3	7.0	5.0	13	6.6	....	23	6.2	....
4	7.0	5.8	14	7.0	....	24	7.5	....
5	7.0	6.2	15	7.0	....	25	6.6	....
6	10	5.7	16	6.6	....	26	7.0	....
7	14	5.2	17	7.0	....	27	6.6	....
8	12	4.6	18	7.0	....	28	7.0	....
9	8.5	4.2	19	8.0	....	29	5.8	....
10	7.5	3.4	20	7.5	....	30	1.0	....
						31	6.6	....

NOTE.—Discharge Aug. 5, Sept. 4–9, 15 and 16 estimated, as gage heights were not available.

Monthly discharge of Douglas Creek near Keystone, Wyo., for the period Oct. 1, 1915, to Nov. 12, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
October	14	4.2	73.5	452
November 1–13	11	2.7	5.04	130
1916.				
April 23–30	24	4.2	13.3	211
May	231	22	121	7,440
June	241	33	148	8,810
July	32	9.5	17.5	1,080
August	20	7.0	11.7	719
September	14	3.8	7.32	436
October	14	1.0	7.23	445
November 1–12	6.2	3.4	5.0	119

BIG CREEK NEAR BIG CREEK, WYO.

Location.—In sec. 32, T. 13 N., R. 81 W., at Big Creek ranger station, 2 miles west of Big Creek post office, in Carbon County. No important tributary within several miles.

Drainage area.—123 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 7, 1911, to June 30, 1912; April 4, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

Gage.—Vertical staff on left bank 50 feet from ranger station; read by Mrs. Mark Edick. Prior to April 29, 1915, gage was 1 foot farther out in the stream and gave readings slightly different although referred to same datum.

Discharge measurements.—Made from cable near gage or by wading at gage.

Channel and control.—Bed composed of coarse gravel and small boulders. Control at gage which is on riffle. Right bank subject to overflow at stage of 4.2 feet; left bank high. Stage of zero flow, 0.6 foot.

Extremes of discharge.—Maximum stage recorded during year, 3.35 feet at 7 p. m. June 19 (discharge, 641 second-feet); minimum discharge probably occurs during winter months.

Winter flow.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were no adjudicated diversions from Big Creek above the station in Wyoming, but below the diversions amount to 100 second-feet. In Colorado Independence ditch diverts from Big Lake to the North Platte drainage basin approximately 80 second-feet, usually from June 10 to July 10 each year. Storage filing for 27,548 acre-feet in Big Lake which supplies Independence ditch.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent except for one change during high water in June. Rating curve used before change, well defined between 30 and 500 second-feet; curve used after the change based on two discharge measurements at stage of about 1.75 feet and the shape of the previous curve. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Big Creek near Big Creek, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 13	H. K. Smith	2.52	305
June 10	R. H. Fletcher	3.02	503
Aug. 15	H. K. Smith	1.78	65

Daily discharge, in second-feet, of Big Creek near Big Creek, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	44	24	76	180	411	332	74	44
2	45	29	41	150	411	296	84	35
3	45	21	42	161	411	260	106	38
4	45	19	50	170	452	244	94	39
5	41	19	50	201	452	227	94	39
6	38	18	49	195	432	227	111	39
7	38	32	44	245	391	211	82	39
8	38	23	49	295	452	227	78	39
9	38	29	47	352	473	227	76	39
10	38	23	67	332	494	244	67	39
11	39	....	84	332	557	260	67	39
12	34	....	94	314	557	211	72	34
13	37	....	86	314	557	183	78	29
14	34	....	78	295	557	180	67	26
15	39	....	78	260	557	170	63	26
16	44	....	84	278	557	155	58	26
17	38	....	108	278	578	141	56	23
18	38	....	119	227	578	147	50	22
19	41	....	103	227	578	138	47	23
20	38	....	78	235	536	116	50	21
21	38	....	74	243	473	108	52	21
22	38	....	76	251	411	103	44	20
23	35	....	124	260	391	98	44	32
24	34	....	150	278	317	89	41	45
25	30	....	173	295	242	86	44	30
26	26	....	183	278	167	82	47	31
27	23	....	192	295	295	82	45	32
28	29	....	234	295	371	82	46	32
29	28	....	208	332	352	82	48	30
30	26	....	167	371	371	82	50	28
31	20	....	....	411	....	78	52	....

NOTE.—Shifting-control methods used June 11–Sept. 30. Discharge estimated Oct. 1, 2, and interpolated May 20–22, June 24, 25, July 2, 4, Aug. 12, 28–30, Sept. 5–10, 23, as gage was not read.

Monthly discharge of Big Creek near Big Creek, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	45	20	36.1	2,220
November 1-10	32	18	23.7	470
April	234	41	100	5.950
May	411	150	269	16.500
June	578	167	446	26.500
July	332	78	167	10.300
August	111	41	64.1	3.940
September	44	20	32.0	1.900

FRENCH CREEK NEAR FRENCH, WYO.

LOCATION.—In sec. 4, T. 14 N., R. 81 W., at Jenkins ranch, 3½ miles southeast of French, in Carbon County. No tributary between station and mouth, 2 miles below.

DRAINAGE AREA.—64 square miles (measured on base map of Wyoming; scale, 1:500,000.)

RECORDS AVAILABLE.—April 30, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on downstream end of heavy rock-filled crib on left bank one-fourth mile above headgate of French Creek Irrigation and Development Company's canal; read by Mrs. J. W. Jenkins.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet upstream from gage or by wading.

CHANNEL AND CONTROL.—Bed composed of small boulders; control 30 feet downstream; shifts occasionally. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.8 feet at 6 p. m. June 10 (discharge, 433 second-feet); minimum discharge occurs during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were no adjudicated diversions from French Creek above the station, but below the station there are diversions of 4 second-feet. From North French Creek there are adjudicated diversions of 6 second-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifts occasionally. Rating curve fairly well defined below 550 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of French Creek near French, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 12	H. K. Smith	2.27	208
June 11	R. H. Fletcher	2.75	420

Daily discharge, in second-feet, of French Creek near French, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	32	23		20	101	338	175	41	27
2	32	24		18	95	275	168	40	24
3	36	22		17	83	295	162	39	23
4	32	21		17	91	338	147	39	23
5	31	22		14	142	361	128	45	21
6	30	22		21	162	316	118	89	21
7	31	25		20	208	275	111	48	21
8	31	26		18	275	316	108	40	21
9	29	25		21	275	361	103	48	28
10	26	24		18	255	384	101	40	35
11	31	24		33	215	384	97	35	25
12	30	25	18	31	222	384	95	34	23
13	31	25	17	30	215	384	85	41	21
14	29	23	19	32	187	361	78	40	20
15	29	21	18	26	156	361	74	34	20
16	26	20	18	30	136	361	69	34	20
17	29	21	18	32	133	338	66	33	18
18	26	20	18	34	125	361	64	29	18
19	26	21	20	31	128	361	60	29	17
20	26	21	23	30	156	316	56	28	17
21	26	23	23	31	178	295	54	30	17
22	25	20	24	33	168	275	49	28	17
23	26	21	23	45	162	233	46	26	17
24	25	23	20	55	184	225	48	24	20
25	25	21	19	76	215	218	50	24	18
26	24	22	20	81	187	208	46	24	19
27	20	21	20	97	178	204	46	25	18
28	24	20	21	111	211	201	46	24	18
29	25	20	19	145	233	191	48	24	18
30	26	20	18	103	316	181	50	33	17
31	26		21		338		48	42	

NOTE.—Shifting-control method used Oct. 1 to Nov. 26. Discharge, Nov. 27–30, estimated because of ice.

Monthly discharge of French Creek near French, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	36	20	27.9	1,720
November	26	20	22.2	1,320
March 12-31	24	17	19.8	787
April	145	14	42.3	2,520
May	338	83	185	11,400
June	384	181	303	18,000
July	175	46	83.7	5,150
August	89	24	35.8	2,200
September	35	17	20.7	1,230

ENCAMPMENT RIVER AT ENCAMPMENT, WYO.

Location.—In sec. 6, T. 14 N., R. 83 W., at lower end of smelter grounds at Encampment, in Carbon County. Nearest tributary, North Fork, enters 1 mile above.

Drainage area.—219 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 2, 1911, to October 31, 1912; May 29, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

Gage.—Chain gage on left bank at tailing flume which crosses the river; read by Earl Waite. Prior to June 6, 1912, gage was 175 feet farther downstream, and although referred to same datum, read approximately one foot lower, owing to the slope of water surface.

Discharge measurements.—Made from cable 125 feet below gage, or by wading.

Channel and control.—Bed composed of gravel and small boulders. Control is not well defined, though there are small rapids 200 feet downstream.

Extremes of discharge.—Maximum stage recorded during year, 7.4 feet at 7 p. m. May 31, and 7 p. m. June 12 (discharge, 2,180 second-feet); minimum discharge occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Three large irrigation ditches divert water at a point 1 mile above the station. The smelter company has a pipe line which diverts water above the station, but as the tailrace of the power plant, which the pipe line supplies, is just above the station, the water diverted passes the gage. Water is also diverted below the station. Prior to December 31, 1916, there were adjudicated diversions from Encampment River amounting to 76 second-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined below 3,000 second-feet. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Encampment River at Encampment, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	R. H. Fletcher	4.49	80	June 9	R. H. Fletcher	7.12	1,850
5	do	4.35	69	Aug. 14	H. K. Smith	4.79	134
May 11	H. K. Smith	6.96	1,580	16	do	4.48	87

Daily discharge, in second-feet, of Encampment River at Encampment, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	70	48	....	700	1,910	805	50	128
2	78	44	....	610	1,910	470	58	81
3	70	45	89	770	1,910	445	155	58
4	73	44	81	1,010	1,910	420	149	48
5	68	50	81	1,420	1,910	352	111	52
6	70	44	89	1,660	1,660	352	109	70
7	52	41	89	1,660	1,780	330	93	101
8	58	41	99	1,660	1,780	330	91	109
9	52	48	81	1,660	1,910	330	99	70
10	50	52	89	1,660	1,910	290	105	58
11	52	50	121	1,660	1,910	290	93	55
12	55	47	146	1,480	2,040	290	163	50
13	59	42	146	1,480	1,910	272	220	42
14	57	45	160	1,660	1,910	255	149	43
15	65	45	190	1,420	1,910	255	111	44
16	70	45	190	1,260	1,910	220	105	45
17	68	45	190	1,100	1,910	205	128	42
18	59	45	238	1,010	1,910	160	75	40
19	87	45	255	1,010	1,780	99	50	43
20	83	45	255	840	1,660	89	58	42
21	73	44	220	1,010	1,540	81	55	43
22	70	44	238	920	1,420	73	51	44
23	68	44	255	1,100	1,260	73	55	40
24	64	44	375	1,200	1,100	60	63	63
25	48	44	552	1,310	1,060	60	75	99
26	48	44	670	1,200	1,100	60	60	133
27	44	42	735	1,360	1,060	60	52	105
28	41	44	1,010	1,420	1,010	60	48	114
29	44	44	965	1,540	1,010	60	89	138
30	52	44	700	1,660	920	60	146	128
31	52	....	....	1,910	....	58	178	....

NOTE.—Discharge, Nov. 15-25, 29, and 30, interpolated because of ice.

Monthly discharge of Encampment River at Encampment, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	87	41	61.3	3,770
November	52	41	45.0	2,680
April 3-30	1,010	81	297	16,500
May	1,910	610	1,300	79,900
June	2,040	920	1,630	97,000
July	805	58	225	13,800
August	220	48	98.2	6,040
September	138	40	70.9	4,220

JACK CREEK AT MATHESON'S RANCH, NEAR SARATOGA, WYO.

LOCATION.—About sec. 36, T. 17 N., R. 86 W., at Matheson's ranch, 14 miles southwest of Saratoga, in Carbon County. Nearest tributary, North Jack Creek, enters some distance below.

DRAINAGE AREA.—32 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—August 23, 1913, to September 30, 1916.

GAGE.—Vertical staff on left bank opposite ranch house; read by Miss Kathleen Montgomery. Prior to August 15, 1915, gage was 800 feet farther downstream and was referred to different datum.

DISCHARGE MEASUREMENTS.—Made from footbridge 1,000 feet below gage or by wading.

Channel and control.—Bed composed of earth. Control 100 feet downstream at small rapids which shift during high water. Banks subject to overflow at stage of 4.0 feet.

Extremes of discharge.—Maximum stage recorded during year, 3.8 feet on May 21 (discharge, 181 second-feet); minimum stage, 1.4 feet on October 2 (discharge, about 3 second-foot).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during the winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 9 second-feet from Jack Creek above the station and 93 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Two poorly defined rating curves were used, one applicable October 1 to November 12, the other March 26 to July 6. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table or by shifting-control method. Records fair.

Discharge measurements of Jack Creek at Matheson's ranch, near Saratoga, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	R. H. Fletcher.........	1.49	5.3	June 8	R. H. Fletcher.........	2.88	73
May 10	H. K. Smith...........	3.18	92	Aug. 13	H. K. Smith...........	1.83	7.7

Daily discharge, in second-feet, of Jack Creek at Matheson's ranch, near Saratoga, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4	7	....	9	29	96	44	10	8
2	3	6	....	7	24	86	44	7	7
3	3	6	....	7	14	81	40	7	7
4	7	6	....	6	24	81	44	10	6
5	5	6	....	6	40	96	37	10	9
6	5	6	....	6	58	102	37	8	9
7	6	9	....	10	86	96	28	12	7
8	5	8	....	9	81	76	27	9	6
9	5	8	....	6	96	76	28	9	7
10	5	8	....	8	102	96	26	22	7
11	6	8	....	12	50	86	20	12	7
12	6	7	....	14	81	96	31	8	7
13	8	....	....	15	76	96	14	8	8
14	9	....	....	15	66	86	13	11	6
15	9	....	....	13	50	86	14	9	7
16	10	....	....	15	37	81	15	8	6
17	10	....	....	13	40	86	12	8	6
18	10	....	....	19	34	76	11	7	7
19	11	....	....	19	44	96	10	10	7
20	11	....	....	11	62	81	10	7	6
21	10	....	....	10	181	81	7	7	7
22	9	....	....	14	102	71	8	7	7
23	8	....	....	22	66	58	8	6	7
24	8	....	....	22	71	44	8	7	8
25	8	....	....	27	76	47	7	6	6
26	8	....	9	34	81	44	7	7	8
27	7	....	8	28	58	44	7	8	7
28	7	....	9	37	58	47	7	6	7
29	7	....	8	47	71	40	7	6	7
30	7	....	12	29	71	44	9	7	7
31	7	....	12	....	81	....	8	20	....

Note.—Gage read Nov. 13 to Dec. 2, but data inadequate for determination of flow. Gage height observations discontinued Dec. 3 to Mar. 25.

ily discharge of Jack Creek at Matheson's ranch, near Saratoga, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ber	11	3	7.2	443
ber 1-12	9	6	7.1	169
M h 15-31	12	8	9.7	115
l	47	6	16.3	970
	181	14	64.8	3,980
	102	40	75.9	4,520
	44	7	19.0	1,170
	22	6	9.0	553
ptember	9	6	7.0	417

MEDICINE BOW RIVER NEAR MEDICINE BOW, WYO.

CATION.—In sec. 7, T. 20 N., R. 79 W., at private bridge at Johnson's ranch, 14 miles southwest of Medicine Bow, in Carbon County. Nearest tributary, Wagonhound Creek, enters 3 miles below.

AINAGE AREA.—178 square miles (measured on base map of Wyoming; scale, 1:500,000).

CORDS AVAILABLE.—June 4, 1911, to November 30, 1912; May 5, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GE.—Vertical staff on downstream side of left abutment; read by Mrs. S. W. Johnson. Gage used during 1911 and 1912 was 600 feet upstream and was referred to different datum.

SCHARGE MEASUREMENTS.—Made from bridge or by wading.

ANNEL AND CONTROL.—Bed composed of gravel. Control 75 feet downstream at bar of well compacted gravel and small boulders; permanent during 1916. Banks not subject to overflow. Stage of zero flow, 1.2 feet.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 3.1 feet at 9 a. m. June 11 (discharge, 688 second-feet); no flow for several days during July.

E.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

VERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 207 second-feet from Medicine Bow River above the station and 67 second-feet below.

ULATION.—None.

CURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 500 second-feet. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except those for low water, which are good.

scharge measurements of Medicine Bow River near Medicine Bow, Wyo., during the year ending Sept. 30, 1916.

te.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6	H. K. Smith	2.26	185
e 13	R. H. Fletcher	2.79	463
5	Robert Follansbee	1.41	10.7

Daily discharge, in second-feet, of Medicine Bow River near Medicine Bow, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept:
1	28	28	....	100	328	136	6	19
2	21	28	51	93	256	111	6	10
3	21	28	48	85	235	100	6	3
4	32	28	48	100	278	65	6	4
5	35	28	65	150	328	53	10	5
6	35	28	55	197	358	48	24	6
7	35	28	43	256	235	38	32	6
8	35	28	43	328	256	27	29	6
9	28	28	48	388	388	24	27	6
10	28	28	65	423	568	22	24	6
11	32	28	85	328	688	20	20	6
12	28	28	107	278	608	11	16	7
13	21	28	89	235	568	8	20	7
14	21	32	93	235	493	6	28	6
15	21	....	93	197	493	6	24	6
16	21	....	79	164	493	4	17	6
17	55	....	79	150	493	3	11	5
18	48	....	79	136	528	2	5	5
19	43	....	79	136	493	2	3	4
20	43	....	69	164	388	2	3	4
21	43	....	60	235	358	1	6	3
22	43	....	60	235	303	1	3	3
23	43	....	73	164	197	1	3	3
24	35	....	89	164	164	0	5	3
25	28	....	89	180	164	0	2	3
26	28	....	107	164	164	1	2	3
27	28	....	111	136	164	0	2	3
28	28	....	136	150	180	2	2	3
29	28	....	111	164	164	4	2	3
30	28	....	100	197	150	7	3	3
31	28	....	....	235	....	8	14	....

Monthly discharge of Medicine Bow River near Medicine Bow, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	55	21	32.0	1,970
November 1-14	32	28	28.3	786
April 2-30	136	43	77.7	4,470
May	423	85	199	12,200
June	688	150	349	20,800
July	136	0	23.0	1,410
August	32	2	11.7	719
September	19	3	5.23	311

ROCK CREEK NEAR ARLINGTON, WYO.

Location.—In sec. 25, T. 19 N., R. 79 W., at highway bridge 1½ miles above Arlington, in Carbon County. Nearest tributary, Overland Creek enters half a mile above. Prior to January 12, 1916, station was at Arlington, 1½ miles downstream. Flow at two points practically the same.

Drainage area.—70 square miles (measured on base map of Wyoming; scale, 1 : 500,000).

Records available.—April 22, 1911, to September 30, 1916.

Gage.—Bristol water-stage recorder on left bank just below bridge.

Discharge measurements.—Made from bridge or by wading.

ANNEL AND CONTROL.—Bed rough; composed of coarse gravel and small boulders. No well-defined control. Banks high and not subject to overflow.

XTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.35 feet at 7 p. m. June 10 (discharge, 661 second-feet); minimum discharge occurred during winter months when discharge relation was affected by ice and was about 6 second-feet, January 19–21.

CE.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

VERSIONS.—Prior to December 31, 1916, there were adjudicated permits for diversion of approximately 4 second-feet from Rock Creek above and 209 second-feet below the station.

ULATION.—None.

CURACY.—Stage-discharge relation not permanent; numerous discharge measurements necessary to define shifts in control. Rating curve used October 1 to November 11 was referred to gage at original site and was well defined; curve used June 7 to September 30 fairly well defined. Operation of water-stage recorder fairly satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph or by shifting-control method. Records good after high water and fair previous to that time.

OPERATION.—Base data furnished by Rock Creek Conservation Co. Some discharge measurements have been made by engineers of United States Geological Survey.

scharge measurements of Rock Creek near Arlington, Wyo., during the year ending Sept. 30, 1916.

ate	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
t. 14	F. T. Cummings	[a] 0.93	21.5	Mar. 28	M. W. Gordon	0.90	21.1
23	M. W. Gordon	[b] .95	27.6	Apr. 10	F. T. Cummings	.90	16.4
29	.....do	[c] .91	19.7	18	.....do	.98	30.1
c. 4	.....do	[d] .98	18.2	May 2	.....do	1.35	71
n. 5	F. T. Cummings	[d] 1.15	13.8	18	.....do	1.72	93
27	M. W. Gordon	[d] 1.36	8.2	25	.....do	2.18	160
b. 19	.....do	[d] .95	10.9	June 7	.....do	2.45	320
24	F. T. Cummings	[d] .90	9.7	14	R. H. Fletcher	2.93	499
Mar. 1	M. W. Gordon	[d] 1.06	8.6	July 1	F. T. Cummings	2.10	214
9	.....do	[d] 1.02	14.5	23	.....do	1.20	41.9
19	.....do	.93	22.7	Aug. 4	M. W. Gordon	1.12	35.5

[a] Old gage read 1.29.
[b] Old gage read 1.43.
[c] Old gage read 1.29.
[d] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Rock Creek near Arlington, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26	16	27	16	8	9	20	67	337	244	38	21
2	28	17	24	18	8	9	18	71	326	250	37	21
3	25	16	23	20	8	10	17	74	410	222	40	19
4	25	14	21	17	8	11	19	85	422	203	37	19
5	21	16	20	14	8	11	18	124	452	190	34	19
6	22	18	18	13	9	11	18	195	406	178	40	19
7	20	19	16	12	10	12	16	236	358	163	32	19
8	21	18	15	12	12	12	18	253	395	149	29	19
9	26	16	18	10	13	14	12	293	471	131	31	18
10	27	16	20	10	14	16	16	306	566	129	31	18
11	25	19	20	9	14	19	18	274	547	118	31	16
12	22	20	24	8	13	23	21	238	528	100	32	14
13	20	18	27	8	13	29	21	219	528	93	33	12
14	18	22	21	8	12	41	24	178	509	83	33	10
15	20	35	18	8	12	41	26	144	547	72	33	10
16	18	33	18	7	12	31	26	127	566	71	33	10
17	30	27	18	7	11	29	27	108	566	70	25	10
18	29	27	18	7	11	26	29	98	547	64	25	10
19	31	22	17	6	11	23	27	100	528	56	23	10
20	29	20	17	6	11	24	26	97	471	53	24	20
21	26	19	19	6	11	26	27	110	414	51	24	20
22	29	20	25	7	11	33	29	118	358	49	23	21
23	29	20	22	10	11	26	29	106	274	43	21	21
24	31	20	19	8	10	24	32	129	306	43	21	20
25	25	19	18	8	10	30	37	160	323	41	21	21
26	18	20	17	8	11	29	43	151	358	38	21	21
27	16	20	16	8	12	24	51	151	340	38	21	20
28	15	22	16	8	12	21	55	193	306	36	20	20
29	17	24	16	8	12	24	59	224	306	37	19	20
30	18	27	16	8	......	25	63	290	259	35	19	20
31	17	......	16	8	......	20	......	347	......	34	20	......

NOTE.—Stage-discharge relation affected by ice Nov. 11 to Mar. 13; determinations of discharge based on frequent measurements, gage heights, and weather records. Discharge interpolated Mar. 17-18, Apr. 28 to May 1, Aug. 11-13, Sept. 11, 29, 30, as gage was out of order. Shifting-control method used Mar. 14 to June 6.

Monthly discharge of Rock Creek near Arlington, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	31	15	23.4	1,440
November	35	14	20.7	1,230
December	27	15	19.4	1,190
January	20	6	9.77	601
February	14	8	11.0	633
March	41	9	22.0	1,350
April	63	12	28.1	1,670
May	347	67	170	10,500
June	566	259	424	25,200
July	250	34	99.5	6,120
August	40	19	28.1	1,730
September	21	10	17.3	1,030
The year	566	6	72.5	52,700

DEEP CREEK NEAR ARLINGTON, WYO.

LOCATION.—In sec. 16, T. 17 N., R. 79 W., at outlet of Sand Lake, 12 miles northwest of Arlington, in Carbon County, at an elevation of 10,100 feet. No tributary within several miles.

DRAINAGE AREA.—3.7 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 30, 1914, to September 30, 1916.

Gage.—Bristol water-stage recorder on left bank just below lake outlet. Prior to October 8, 1915, gage was 160 feet upstream, and was referred to different datum.

Discharge measurements.—Made by wading.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—No diversions above.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 40 second-feet. Water-stage recorder did not operate correctly during year, and only weekly staff gage readings are available. Discharge ascertained only for days on which staff gage was read.

Cooperation.—Field data furnished by Rock Creek Conservation Co.

Discharge measurements of Deep Creek near Arlington, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	F. T. Cummings	[a]0.92	1.07	Mar. 30	M. W. Gordon	0.85	0.73
10	do	[a].92	1.18	May 6	F. T. Cummings	[b]3.05	3.98
30	M. W. Gordon	.92	1.42	June 4	do	2.20	31.6
Jan. 1	F. T. Cummings	.85	.92	July 12	do	1.60	12.4
Feb. 21	M. W. Gordon	.83	.58	Aug. 3	M. W. Gordon	1.20	3.42

[a] Old gage read 0.63 feet.

[b] Stage-discharge relation seriously affected by log jam.

Daily discharge, in second-feet, of Deep Creek near Arlington, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.6			0.8					30			
2												
3			1.0								3.0	
4									32			
5		1.3										
6							0.8	4.0				1.6
7				.8	1.0						3.0	
8									32	18		
9						1.0						
10	1.1								28			
11								5.0				
12		3.0								13		
13							1.0					
14				.8	.8						2.6	1.3
15						.5			43	10		
16												
17	1.6											
18								5.8				
19		3.0										
20							.8					
21				.8	.6							1.3
22						.5			41	3.8	1.6	
23	1.3											
24												
25								9.4				
26		1.3										
27							1.3					
28					1.0							
29	1.3											1.5
30	1.1			.9		.8			26	4.5	1.6	
31												

Note.—Operation of water-stage recorder unsatisfactory; and discharge given only for days on which staff gage was read. Data insufficient for determination of monthly discharge. Discharge estimated May 11.

MUDDY CREEK NEAR SHIRLEY, WYO.

Location.—In sec. 14, T. 26, N., R. 80 W., at highway bridge near Point of Rocks, 6 miles east of Shirley, in Carbon County. Nearest tributary enters 4 miles above.

Drainage area.—67 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 6, 1915, to September 30, 1916.

Gage.—Vertical staff on downstream side of left abutment of bridge; read by Dave Wray.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Channel winding; bed composed of mud; sluggish current due to slight slope (0.0011 foot). Control practically at gage during low and medium stages, but during high water control is at first bend downstream. Left bank subject to overflow at stage 3.5 feet, right bank at stage 6.6 feet.

Extremes of discharge.—Maximum stage during year, determined by levels from high-water mark, approximately 8.1 feet (discharge not determined); minimum stage, 0.50 foot for long periods during summer months (discharge 0.3 second-foot).

Maximum stage recorded during period 9.72 feet at 7 a. m. August 23, 1915, (discharge not determined); minimum discharge, creek dry for periods in summer.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 3.2 second-feet from Muddy Creek above station and 4.8 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve not well defined. Gage read to hundredths twice daily; during high water read more often. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Muddy Creek near Shirley, Wyo., during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 6	R. H. Fletcher	0.95	3.4	May 7	H. K. Smith	1.93	29.7
June 17	do	.38	[a] .2	June 13	R. H. Fletcher	.97	2.2
Sept. 25	do	2.24	53				

[a] Estimated.

Daily discharge, in second-feet, of Muddy Creek near Shirley, Wyo., for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1915.						1915.					
1	....	7.0	0	0	0.7	16	0	0.3	0	0.2	4.0
2	....	6.0	0	0	26	17	0	.2	0	0	3.0
3	....	5.0	0	0	122	18	0	.2	0	0	3.0
4	....	7.0	0	0	15	19	0	.1	0	0	3.0
5	....	4.0	0	0	15	20	.8	0	0	0	3.0
6	2.0	21	0	0	11	21	3.0	0	0	9.0	3.0
7	3.0	20	0	0	6.0	22	7.0	0	0	136	3.0
8	14	6.0	0	.5	2.0	23	7.0	0	0	330	3.0
9	7.0	5.0	0	49	2.0	24	3.0	0	0	102	3.0
10	1.0	5.0	0	.5	2.0	25	.9	.2	0	60.	3.0
11	.9	2.0	0	0	1.0	26	.7	0	0	22	54
12	.6	1.0	0	0	2.0	27	13	0	9.0	1.0	30
13	.3	.9	0	0	36	28	5.0	0	46	1.0	13
14	0	2.0	0	2.0	10	29	3.0	0	6.0	1.0	9.0
15	0	.6	0	3.0	6.0	30	55	0	.3	.8	6.0
						31	15	....	0	.7	....

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	5	4	....	9	11	14	0.3	0.3	15.3
2	4	4	....	8	11	22	.3	.3	10
3	3	4	....	7	10	13	.3	.3	.7
4	3	4	....	6	14	14	.3	.3	.5
5	3	4	....	8	14	13	.3	.3	.4
6	3	4	....	6	15	10	.3	.3	.3
7	3	4	....	6	22	11	.3	.3	.3
8	3	4	....	5	20	10	.3	.3	.3
9	3	4	....	9	17	9.0	.3	.3	.3
10	3	3	....	16	21	6.0	.3	.3	.3
11	3	3	....	24	21	6.0	.3	.3	.3
12	3	3	....	22	21	4.0	.3	.3	.3
13	4	2	....	18	21	3.0	.3	.3	.3
14	4	2	....	15	18	4.0	.3	.3	.3
15	5	2	....	15	17	2.0	.3	.3	.3
16	5	1	....	18	15	1.0	.3	.3	.3
17	4	1	....	12	13	1.0	.3	.3	.3
18	4	.9	....	16	16	1.0	.3	.3	.3
19	5	.9	103	16	14	.9	.3	.3	.3
20	5	1	99	9	15	1.0	.3	.3	.3
21	5	....	58	11	28	.9	.3	42	.3
22	4	....	35	20	22	.8	.3	.7	.3
23	4	....	34	20	16	.5	.3	.4	.3
24	4	....	24	17	18	.4	.3	.4	.3
25	4	....	24	16	17	.4	.3	.3	.3
26	4	....	15	16	14	.4	.3	.3	.3
27	4	....	13	13	17	.4	.3	.3	.3
28	4	....	16	15	13	.4	.3	.3	.3
29	4	....	16	18	13	.3	.3	.3	.4
30	4	....	8	13	13	.3	.3	.4	.4
31	4	....	9	....	13	....	.3	41	....

NOTE.—Discharge Oct. 1–2, 1915, interpolated; Nov. 10–17 estimated because of ice. Run-off began Mar. 12, 1916, and reached a maximum stage of 8.1 feet before observer began readings.

Monthly discharge of Muddy Creek near Shirley, Wyo., for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
May 6-31	55	0	5.47	282
June	21	0	3.12	186
July	46	0	1.98	122
August	330	0	23.2	1,430
September	122	.7	13.3	791
The period				2,810
1915-16.				
October	5	3	3.87	238
November 1-20	4	.9	2.79	111
March 19-31	103	8	34.9	900
April	24	5	13.5	803
May	28	10	16.2	1,010
June	22	.3	5.02	299
July	.3	.3	.30	18
August	42	.3	2.98	183
September	15	.3	1.14	68

SAGE CREEK ABOVE PATHFINDER, WYO.

Location.—In sec. 3, T. 26 N., R. 84 W., at footbridge at Vivion's ranch, 25 miles above Pathfinder dam, in Carbon County. No tributary between station and mouth 2 miles below.

Drainage area.—182 square miles (measured on base map of Wyoming; scale, 1:500,000.)

Records available.—March 20, 1915, to September 30, 1916.

Gage.—Vertical staff on left bank, 5 feet above footbridge; read by Mrs. Lewis Stillway.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Bed composed of boulders embedded in sand. Control a short distance below bridge at riffle, which is permanent. Banks subject to overflow at stage of 6.5 feet. Stage of zero flow, 0.9 foot.

Extremes of discharge.—Maximum stage recorded during year, 3.45 feet at 9 p. m. March 9 (discharge, 199 second-feet); practically dry for periods during the summer.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 16 second-feet from Sage Creek, all above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Sage Creek above Pathfinder, Wyo., during the year ending Sept. 30, 1916.

[Made by R. H. Fletcher.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 14	1.68	8.7	May 24	2.18	36.3
May 12	2.47	64	May 25	2.16	32.9

Daily discharge, in second-feet, of Sage Creek above Pathfinder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.8	7.5	....	30	68	20	0.9	0.6	1.0
2	9.0	7.5	....	33	65	21	1.0	.6	.9
3	8.7	7.5	....	41	63	9.0	.8	.6	1.3
4	8.7	7.5	....	39	58	8.4	.8	.6	1.5
5	8.7	7.2	26	28	53	10	.8	.6	1.6
6	8.4	7.2	26	22	54	10	.6	.8	2.1
7	8.4	7.2	17	19	74	8.7	.5	.8	2.2
8	8.1	6.9	21	16	72	7.2	.7	.7	2.2
9	8.1	7.8	94	25	74	7.8	.8	.8	2.3
10	8.4	9.0	98	25	78	6.3	.7	.8	2.0
11	8.7	11	51	39	69	3.5	.6	.8	1.9
12	9.0	12	94	50	63	1.8	.6	.8	1.9
13	9.0	11	96	45	57	2.0	.7	.8	1.7
14	7.8	10	58	36	54	1.8	.6	.8	1.5
15	6.6	8.4	42	41	46	1.7	.6	.8	1.3
16	8.4	7.8	33	43	45	1.6	.6	.8	1.2
17	9.8	8.1	35	35	41	1.6	.5	.8	1.2
18	9.8	8.1	46	44	31	1.7	.5	.9	1.2
19	9.8	8.4	48	46	28	1.4	.5	.9	1.2
20	9.0	8.4	86	45	32	1.6	.5	.9	1.1
21	9.0	8.4	27	42	56	1.7	.5	.9	1.1
22	8.7	7.8	95	48	52	1.6	.6	.9	1.2
23	8.7	7.8	81	50	37	1.7	.6	.8	1.2
24	8.4	7.8	54	51	35	1.6	.6	.8	1.2
25	8.4	7.8	44	57	34	1.1	.6	.8	1.2
26	8.4	7.2	40	63	32	1.0	.6	.8	1.1
27	8.4	7.2	39	63	28	.9	.5	.9	1.1
28	7.8	....	39	67	24	1.0	.5	.9	1.1
29	7.8	....	42	77	26	.9	.6	1.0	1.0
30	7.2	....	26	69	23	.8	.6	1.0	1.0
31	7.8	....	23	....	22	....	.6	1.0	....

Monthly discharge of Sage Creek above Pathfinder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9.8	7.2	8.54	525
November 1-27	12	6.9	8.24	441
March 5-31	98	17	51.1	2,740
April	77	16	43.0	2,560
May	78	22	48.2	2,960
June	21	.8	4.65	277
July	1.0	.5	0.63	38.7
August	1.0	.6	0.81	49.8
September	2.3	.9	1.42	84.5

SAND CREEK NEAR ALCOVA, WYO.

Location.—About sec. 25, T. 28 N., R. 85 W., at Weaver's ranch, 20 miles southwest of Alcova, in Carbon County. No tributary between station and Pathfinder reservoir, the flow line of which is one-half mile below gage.

Drainage area.—70 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 1 to September 30, 1915, and April 3 to September 9, 1916.

Gage.—Vertical staff, read by Clarence Burtch.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 28 second-feet from Sand Creek, all above the station.

Regulation.—None.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Sand Creek near Alcova, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	....	5.2	10	....	16	10	5.2	2.6	....
2	....	5.2	5.2	....	17	5.2	5.2	2.6	....
3	25	5.2	10	....	18	10	5.2	2.6	....
4	25	5.2	5.2	....	19	10	5.2	2.6	....
5	20	5.2	5.2	....	20	25	5.2	2.6	....
6	20	5.2	2.6	....	21	15	25	2.6	....
7	22	5.2	2.6	....	22	5.2	15	2.6	0.1
8	22	5.2	2.6	....	23	10	10	2.6	....
9	22	5.2	2.6	0.5	24	15	5.2	2.6	.1
10	13	.7	5.2	.1	25	5.2	5.2	2.6	....
11	15	5.2	5.2	....	26	7.7	5.2	2.6	....
12	20	5.2	5.2	....	27	10	10	2.6	....
13	13	5.2	10	....	28	15	10	2.6	.1
14	13	7.7	5.2	....	29	15	10	....	....
15	5.2	7.7	5.2	.3	30	5.2	5.2	....	....
					31	....	10	....	....

NOTE.—Creek dry June 29 to Sept. 9, except on July 9, 10, 15, 22, 24, and 28.

Monthly discharge of Sand Creek near Alcova, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 3-30	25	5.2	14.2	789
May	25	.7	6.95	427
June	10	.0	3.86	230
July	.5	.0	.39	2.4
The period				1,450

NOTE.—Monthly flow computed by engineers of the United Sates Geological Survey from record of daily discharge furnished by United States Reclamation Service.

SWEETWATER RIVER NEAR ALCOVA, WYO.

LOCATION.—In sec. 17, T. 29 N., R. 86 W., at Schoonmaker's ranch, 27 miles west of Alcova, in Natrona County. Backwater from Pathfinder reservoir comes to a point 5 miles below. Nearest tributary, Dry Creek, enters 6 miles below.

DRAINAGE AREA.—2,270 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—August 28, 1913, to September 30, 1916.

GAGE.—Vertical staff on left bank at old bridge abutment 200 feet above footbridge; read by H. D. Schoonmaker.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control 25 feet downstream at small rapids which change during high water. Banks high and not subject to overflow. Stage of zero flow, 0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.46 feet at 5 p. m., May 2 (discharge, 964 second-feet); minimum discharge probably occurs during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 102 second-feet from Sweetwater River above the station. The original diversions below the station have been submerged by Pathfinder reservoir.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent, but shifts between fairly well defined limits. Fairly well defined standard rating curve used indirectly most of year. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except March 12 to May 24 and July 1 to September 30, for which it was determined by shifting-control method. Records fair.

Discharge measurements of Sweetwater River near Alcova, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
	R. H. Fletcher	0.77	90	Apr. 26	R. B. Diemer	2.26	455
	do	.75	85	27	do	2.55	534
3	R. B. Diemer[a]	1.18	200	27	do	2.55	539
4	do	1.22	206	May 11	R. H. Fletcher	3.34	930

[a] Engineer for United States Reclamation Service.

Daily discharge, in second-feet, of Sweetwater River near Alcova, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	92	82		219	938	347	160	59	51
	95	80		203	938	347	155	59	51
	96	80		199	798	379	146	59	51
	92	80		201	563	379	141	59	48
	92	80		208	543	379	128	59	49
	92	80		208	523	379	124	59	47
	93	80		208	584	379	116	58	46
	93	78		201	668	413	113	58	46
	90	79		190	775	448	109	59	44
	90	80		182	870	448	106	59	44
	90	80		172	960	413	102	59	44
	87	80	106	176	915	448	101	59	44
	87	80	190	262	915	485	95	59	44
	87	80	262	466	870	485	92	59	46
	87	80	219	604	775	485	90	59	44
	87	80	180	625	668	466	88	58	42
	85	80	190	710	563	430	85	57	41
	86	80	236	775	504	413	80	56	39
	85	80	249	775	448	413	80	55	39
	85		289	754	430	448	78	55	39
	85		485	668	413	448	76	55	39
	82		732	543	430	430	76	55	39
	82		625	430	448	430	76	55	39
	81		448	396	485	363	75	55	42
	82		289	430	485	317	74	55	38
	81		276	466	413	276	74	55	38
	80		212	543	379	224	74	55	38
	80		210	625	363	208	74	55	39
	80		203	732	347	184	72	55	46
	80		192	775	347	166	69	55	46
	82		203		347		65	55	

Monthly discharge of Sweetwater River near Alcova, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	95	80	86.6	5,320
November 1-19	82	78	79.9	3,010
March 12-31	732	105	290	11,500
April	775	172	432	25,700
May	960	347	603	37,100
June	485	166	381	22,700
July	160	65	96.6	5,940
August	59	55	57.1	3,510
September	51	38	43.4	2,580

HORSE CREEK NEAR ALCOVA, WYO.

Location.—About sec. 22, T. 30 N., R. 85 W., at highway bridge near Bothwell ranch, 16 miles west of Alcova in Natrona County. No tributary between statio and Pathfinder reservoir, the flow line of which is half a mile below gage.

Drainage area.—119 square miles (measured on base map of Wyoming; scal 1:500,000).

Records available.—March 23, 1915, June 30, 1916.

Gage.—Vertical staff on right bank at lower side of bridge; read by A. L. Johnso and P. J. Wilder.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of coarse gravel. Control a short distanc below gage.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinue during winter.

Diversions.—Prior to July 1, 1914, there were adjudicated diversions of 11 second feet from Horse Creek, and 2 second-feet from tributaries, all above the statio

Regulation.—None.

Cooperation.—Daily discharge records furnished by the United States Reclamatio Service.

Daily discharge, in second-feet, of Horse Creek near Alcova, Wyo., for the year ending Sept 30, 1916.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1	....	3.3	0.9	1.1	16	....	0.7	0.4	0.
2	....	8.5	.9	1.7	17	....	.9	.7	.
3	....	4.5	1.7	1.7	18	55	2.5	.9	1.
4	....	7.0	.5	.7	19	61	2.5	.9	1.
5	....	9.4	.5	.5	20	62	.5	.7	.
6	....	100	.7	.7	21	64	.5	.7	.
7	....	14	.5	.4	22	66	.4	.9	.
8	....	11	.7	.5	23	34	1.7	.9	.
9	....	12	.5	.5	24	29	1.7	1.1	.
10	....	3.9	.5	.5	25	6.3	.5	1.1	.
11	....	1.1	1.1	.5	26	8.5	.9	.7	.
12	....	3.1	1.7	.7	27	3.9	.7	.7	.
13	....	.9	.7	.5	28	11	.9	.7	.
14	....	.4	.7	.4	29	6.3	1.7	.7	.
15	....	.1	.5	.5	30	8.5	.9	1.1	.
					31	7.0	....	1.7	....

Monthly discharge of Horse Creek near Alcova, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 18-31	66	3.9	30.2	839
April	14	.4	3.53	211
May	1.7	.4	.84	51.6
June	1.7	.4	.72	42.8
The period	66	.4	5.49	1,140

Note.—Monthly discharge computed by engineers of the United States Geological Survey from records of daily flow furnished by the United States Reclamation Service.

CANYON CREEK NEAR ALCOVA, WYO.

LOCATION.—About sec. 2, T. 28 N., R. 84 W., at Irvine's ranch, 12 miles southwest of Alcova, in Carbon County. No tributary between station and Pathfinder reservoir, the flow line of which is a mile below gage.

DRAINAGE AREA.—54 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1916.

GAGE.—Vertical staff; read by F. J. Irvine.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 3.9 second-feet from Canyon Creek, and 13 second-feet from tributaries entering above.

REGULATION.—None.

COOPERATION.—Daily discharge records furnished by the United States Reclamation Service.

Daily discharge, in second-feet, of Canyon Creek near Alcova, Wyo., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	Aug.	Sept.
1		8.0	9.8	0.5		0.5	16	9.8	7.6	3.0			1.4
2		9.5	10			.9	17	11	8.0	2.2	0.5		1.2
3		8.4	11			.6	18	13	8.9	1.2	.6		1.4
4		8.0	9.8			.9	19	12	10	1.4	.6		1.2
5	30	8.4	8.0			1.2	20	17	12	2.0			1.4
6	32	8.0	7.0			1.1	21	17	16	7.0			1.4
7	17	7.0	6.4			1.4	22	14	12	3.9			.9
8	42	7.0	6.0			1.2	23	17	12	2.7			.7
9	17	8.4	5.2			1.4	24	7.0	12	2.2			1.2
10	62	8.4	4.5			1.1	25	8.0	11	2.2			1.7
11	36	10	4.2			1.2	26	8.3	12	2.1	.3	0.3	1.2
12	42	10	3.9	.2		1.1	27	8.9	11	1.8			2.0
13	28	9.4	4.2	.5		.7	28	9.4	12	1.8		.6	2.0
14	13	8.0	4.8	.6		1.2	29	8.0	12	1.2		.7	2.2
15	8.9	7.0	4.5	.3		1.2	30	5.7	10	1.2		1.1	2.2
							31	7.6		1.4		.6	

NOTE.—Creek dry June 2-11, 16, 20-25, and June 27 to Aug. 25, 27.

Monthly discharge of Canyon Creek near Alcova, Wyo., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 5-31	62	5.7	18.6	996
April	16	7.0	9.73	579
May	11	1.2	4.41	271
June	.6	.0	0.14	8.3
July	.0	.0	.0	0
August	1.1	.0	.11	6.8
September	2.2	0.5	1.26	75.0
The period				1,940

NOTE.—Monthly discharge computed by engineers of the United States Geological Survey from records of daily flow furnished by the United States Reclamation Service.

BATES CREEK NEAR CASPER, WYO.

Location.—Approximately in sec. 12, T. 31 N., R. 82 W., near mouth of creek, 21 miles southwest of Casper, in Natrona County.

Drainage area.—383 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 10 to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 72 second-feet from Bates Creek, all above the station.

Cooperation.—Daily discharge records furnished by the United States Reclamation Service.

Daily discharge, in second-feet, of Bates Creek near Casper, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	July.	Aug.	Sept.	Day.	Apr.	May.	July.	Aug.	Sept.
1	....	42	....	1.0	9.0	16	[a]80	....	[a]1.0	9.0	0.5
2	....	35	....	1.0	.5	17	71	....	1.0	1.0	[a].5
3	....	35	....	1.0	[a].5	18	71	....	1.0	1.0	.5
4	....	20	....	1.0	.5	19	77	....	1.0	.5	.5
5	....	20	....	.5	.5	20	84	....	1.0	[a].5	.5
6	....	8.0	....	[a].5	.5	21	71	....	1.0	.5	.5
7	....	[a]1.5	....	.5	.5	22	77	....	1.0	.5	.5
8	....	....	....	.5	.5	23	[a]71	....	[a]1.0	.5	.5
9	....	....	....	38	.5	24	63	....	1.0	.5	[a].5
10	68	....	....	38	[a].5	25	56	....	1.0	.5	.5
11	97	....	300	9.0	.5	26	56	....	1.0	.5	.5
12	135	....	1.0	1.0	.5	27	49	....	1.0	[a].5	.5
13	97	....	1.0	[a]1.0	.5	28	71	....	1.0	.5	.5
	84	....	1.0	1.0	.5	29	71	....	1.0	.5	1.0
1	90	....	1.0	24	.5	30	[a]56	....	[a]1.0	.5	1.0
						31	....	....	1.0	24	....

[a] Sunday; discharge interpolated as gage was not read.

Note.—Practically no flow May 8 to July 10.

Monthly discharge of Bates Creek near Casper, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 10-30	135	49	75.7	3,150
May	42	0	5.21	320
June	0	0	0	0
July	300	0	10.3	633
August	38	.5	5.13	315
September	9	.5	.82	48.8
The period	....	....	....	4,470

Note.—Monthly flow computed by engineers of the United States Geological Survey from records of daily discharge furnished by the United States Reclamation Service.

DEER CREEK AT GLENROCK, WYO.

Location.—In sec. 4, T. 33 N., R. 75 W., near mouth of creek at Glenrock, in Converse County.

Drainage area.—63 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 11 to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 48 second-feet from Deer Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Deer Creek at Glenrock, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		338	140	0.5	0.2	0.2	16	338	186	9.0	132	0.2	0.2
2		304	104	.5	.2	.2	17	405	182	7.0	33	.2	.2
3		315	124	.5	.2	.2	18	439	168	6.8	.6	.2	.2
4		251	93	.5	.2	.2	19	392	147	5.6	.6	.2	.2
5		251	82	.3	.2	.2	20	283	147	5.2	.6	.2	.2
6		292	70	.3	.2	.2	21	392	350	5.2	.6	.2	.2
7		190	68	.3	.2	.2	22	403	432	5.0	.6	.2	.2
8		186	52	.3	.2	.2	23	403	436	4.8	.6	.2	.2
9		330	43	.3	.2	.2	24	389	360	5.4	.6	.2	.2
10		318	33	.5	.2	.2	25	421	304	3.0	.5	.2	.2
11	394	308	33	.3	.2	.2	26	425	236	2.5	.5	.2	.2
12	400	300	29	.3	.2	.2	27	382	220	1.4	.5	.2	.2
13	396	195	22	.3	.2	.2	28	338	215	.5	.5	.5	.2
14	280	190	21	.3	.2	.2	29	405	177	.5	.3	.2	.2
15	304	186	9.0	.5	.2	.2	30	385	164	.5	.3	.2	.3
							31		164		.3	.2	

Note.—Discharge estimated May 9–13, and records changed to conform to rules of United States Geological Survey.

Monthly discharge of Deer Creek at Glenrock, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 11-30	439	280	379	15,000
May	436	147	253	15,600
June	140	.5	32.8	1,950
July	132	.3	5.74	353
August	.2	.2	.20	12.3
September	.3	.2	.20	11.9
The period				32,900

Note.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by United States Reclamation Service.

BOXELDER CREEK NEAR CAREYHURST, WYO.

Location.—Approximately in sec. 7, T. 33 N., R. 73 W., near mouth of creek 1½ miles east of Careyhurst, in Converse County.

Drainage area.—193 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 17, to October 31, 1911; April 9 to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 80 second-feet from Boxelder Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Boxelder Creek near Careyhurst, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		203	70	4.5	4.5	4.5	16	194	124	6.0	4.5	4.5	4.5
2		168	70	4.5	4.5	4.5	17	203	115	5.0	4.5	4.5	4.5
3		160	35	4.5	4.5	4.5	18	177	124	5.0	4.5	4.5	4.5
4		160	24	4.5	4.5	4.5	19	177	106	5.0	4.5	4.5	4.5
5		168	24	4.5	4.5	4.5	20	186	106	5.0	4.5	4.5	4.5
6		168	35	4.5	4.5	4.5	21	186	194	5.0	4.5	4.5	4.5
7		168	42	4.5	4.5	4.5	22	203	222	5.0	4.5	4.5	4.5
8		142	42	4.5	4.5	4.5	23	237	212	5.0	4.5	4.5	4.5
9	124	194	19	4.5	4.5	4.5	24	203	203	5.0	4.5	4.5	4.5
10	150	186	9.0	4.5	4.5	4.5	25	222	212	5.0	4.5	4.5	4.5
11	186	186	9.0	4.5	4.5	4.5	26	222	160	5.0	4.5	4.5	4.5
12	212	168	9.0	4.5	4.5	4.5	27	177	142	5.0	4.5	4.5	4.5
13	203	142	9.0	4.5	4.5	4.5	28	186	124	4.5	4.5	4.5	4.5
14	186	142	6.0	4.5	4.5	4.5	29	230	106	4.5	4.5	4.5	4.5
15	168	132	6.0	4.5	4.5	4.5	30	168	88	4.5	4.5	4.5	4.5
							31		70		4.5	4.5	

Monthly discharge of Boxelder Creek near Careyhurst, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 9-30	237	124	191	8,330
May	222	70	155	9,530
June	70	4.5	16.1	958
July	4.5	4.5	4.5	277
August	4.5	4.5	4.5	277
September	4.5	4.5	4.5	268
The period				19,600

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from records of daily discharge furnished by United States Reclamation Service.

LA PRELE CREEK NEAR FETTERMAN, WYO.

Location.—Approximately in sec. 9, T. 33 N., R. 72 W. near mouth of creek, 4 miles east of Fetterman, in Converse County.

Drainage area.—227 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 23 to August 5, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversion of 73 second-feet from La Prele Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of La Prele Creek near Fetterman, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		62	71	6.7	3.7	16		118	6.7	9.3	
2		62	62	6.7	3.2	17		98	6.7	5.0	
3		80	53	6.7	3.2	18		108	5.0	9.3	
4		89	35	6.7	3.2	19		108	5.0	6.7	
5		98	13	6.7	3.0	20		108	6.7	9.3	
6		98	13	6.7		21		108	5.0	9.3	
7		98	6.7	5.0		22		108	5.0	6.7	
8		98	5.0	5.0		23	25	108	5.0	5.0	
9		98	5.0	5.0		24	25	108	5.0	5.0	
10		98	6.7	6.7		25	35	108	6.7	3.7	
11		98	6.7	6.7		26	35	108	5.0	5.0	
12		108	6.7	5.0		27	35	108	5.0	6.7	
13		108	6.7	3.7		28	44	108	5.0	6.7	
14		108	6.7	3.7		29	44	108	6.7	5.0	
15		108	6.7	25		30	62	98	5.0	3.7	
						31		98		3.7	

ly discharge of La Prele Creek near Fetterman, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
r-30	62	25	38.1	605
	118	62	101	6,210
	71	5.0	12.9	768
	25	3.7	6.65	409
1-5	3.7	3.0	3.26	32.3
he period				8,020

—Monthly discharge computed by engineers of United States Geological Survey from records of ischarge furnished by United States Reclamation Service.

WAGON HOUND CREEK NEAR LABONTE, WYO.

ATION.—Approximately in sec. 16, T. 31 N., R. 71 W., at Eastman's ranch, near outh of creek, 3 miles east of LaBonte, in Converse County.

AINAGE AREA.—145 square miles (measured on base map of Wyoming; scale, 1 500,000).

CORDS AVAILABLE.—April 11 to September 30, 1916.

ERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 24 second-feet from Wagon Hound Creek, all above the station.

ERATION.—Daily discharge records furnished by United States Reclamation Service.

ischarge, in second-feet, of Wagon Hound Creek near LaBonte, Wyo., for the year ending Sept. 30, 1916.

	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
	......	12	1.0	1.0	1.0	1.0	16....	69	1.0	1.0	1.0	1.0	0.2
	......	8.5	1.0	1.0	1.0	.2	17....	88	1.0	1.0	1.0	1.0	.2
	......	5.5	1.0	1.0	1.0	.2	18....	59	1.0	1.0	1.0	1.0	.2
	......	3.0	1.0	3.0	1.0	.2	19....	69	1.0	1.0	1.0	1.0	.2
	......	1.0	1.0	3.0	1.0	.2	20....	59	1.0	1.0	1.0	1.0	.2
	......	.2	1.0	3.0	1.0	.2	21....	69	1.0	1.0	1.0	1.0	.2
	......	3.0	1.0	3.0	1.0	.2	22....	100	40	1.0	1.0	1.0	.2
	......	1.0	1.0	69	5.5	.2	23....	100	24	1.0	1.0	1.0	.2
	......	1.0	1.0	3.0	1.0	.2	24....	69	18	1.0	1.0	1.0	.2
	......	.2	1.0	3.0	1.0	.2	25....	49	12	1.0	1.0	1.0	.2
	59	.2	1.0	3.0	1.0	.2	26....	49	12	1.0	1.0	1.0	.2
	88	1.0	3.0	3.0	1.0	.2	27....	40	8.5	1.0	1.0	1.0	.2
	59	1.0	5.5	3.0	1.0	.2	28....	8.5	8.5	1.0	1.0	1.0	.2
	49	1.0	3.0	3.0	1.0	.2	29....	8.5	5.5	1.0	1.0	1.0	.2
	59	1.0	1.0	3.0	1.0	.2	30....	24	3.0	1.0	1.0	1.0	.2
							31....	....	1.0	....	1.0	1.0	....

ly discharge of Wagon Hound Creek near LaBonte, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ril 11-30	100	8.5	58.7	2,330
	40	.2	5.76	354
	5.5	1.0	1.28	76.2
	69	1.0	3.90	240
ust	5.5	1.0	1.15	70.7
ptember	1.0	.2	.23	13.7
The period				3,080

—Monthly discharge computed by engineers of United States Geological Survey from records of discharge furnished by United States Reclamation Service.

LABONTE CREEK NEAR LABONTE, WYO.

Location.—Approximately in sec. 15, T. 31 N., R. 71 W., at Wiederander's ranch near mouth of creek, 2 miles east of LaBonte, in Converse County.

Drainage area.—270 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 12 to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 34 second-feet from LaBonte Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of LaBonte Creek near LaBonte, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		257	61	1.5	1.5	0.8	16	326	122	24	1.5	1.5	0.6
2		252	60	1.5	1.5	.8	17	343	127	15	1.5	1.5	.4
3		235	58	1.5	1.5	.8	18	337	114	12	1.5	1.5	.4
4		218	55	1.8	1.5	.8	19	331	98	12	1.5	1.5	.4
5		206	54	1.5	1.5	.8	20	320	96	13	1.5	1.2	.4
6		203	32	1.5	1.5	.8	21	308	116	16	1.5	1.2	.4
7		220	30	1.5	1.5	.8	21	311	172	12	1.5	1.2	.4
8		203	26	1.5	1.5	.8	23	308	141	8.4	1.5	1.2	.4
9		192	20	1.5	1.5	.8	24	303	141	7.9	1.5	1.2	.3
10		178	13	1.5	1.5	.6	25	314	139	7.9	1.5	1.2	.3
11		161	12	4.0	1.5	.6	26	311	127	6.9	1.5	1.2	.3
12	314	146	29	1.5	1.5	.6	27	297	118	6.9	1.5	1.0	.3
13	303	141	29	1.5	1.5	.6	28	300	102	4.6	1.5	1.0	.3
14	269	137	28	1.5	1.5	.6	29	314	89	2.3	1.5	1.0	.3
15	269	131	26	1.5	1.5	.6	30	291	77	1.6	1.5	1.0	.3
							31		68		1.5	1.0	

Monthly discharge of LaBonte Creek near LaBonte, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 12-30	343	269	309	11,600
May	257	68	152	9,350
June	61	1.6	22.8	1,360
July	4.0	1.5	1.59	97.8
August	1.5	1.0	1.35	83.0
September	.8	.3	.54	32.1
The period				22,500

Note.—Monthly discharge computed by engineers of United States Geological Survey from records of daily discharge furnished by the United States Reclamation Service.

HORSESHOE CREEK NEAR GLENDO, WYO.

Location.—Approximately in sec. 26, T. 29, N., R. 68 W., at Hauf's ranch near mouth of creek, 4 miles southeast of Glendo, in Platte County.

Drainage area.—203 square miles (measured on base map of Wyoming; scale 1:500,000).

Records available.—April 16 to September 2, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 81 second-feet from Horseshoe Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Horseshoe Creek near Glendo, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	102	19	3.0	2.5	2.5	16....	126	21	3.6	2.6	2.4	....
2	....	60	19	2.9	2.5	2.5	17....	132	21	3.6	2.6	2.4	....
3	....	50	18	2.9	2.5	....	18....	134	21	3.6	2.6	2.4	....
4	....	56	18	2.9	2.5	....	19....	132	21	3.4	2.6	2.4	....
5	....	39	12	2.9	2.5	....	20....	130	21	3.4	2.6	2.4	....
6	....	33	5.1	2.8	2.5	....	21....	122	20	3.3	2.6	2.4	....
7	....	31	4.2	2.7	2.5	....	22....	122	20	3.3	2.5	2.4	....
8	....	28	4.2	2.7	2.5	....	23....	120	20	3.2	2.5	2.4	....
9	....	27	4.2	2.7	2.4	....	24....	120	20	3.2	2.5	2.4	....
10	....	26	4.2	2.7	2.4	....	25....	118	20	3.1	2.5	2.4	....
11	....	25	3.9	2.7	2.4	....	26....	118	20	3.1	2.5	2.4	....
12	....	24	3.9	2.7	2.4	....	27....	115	20	3.0	2.5	2.4	....
13	....	24	3.7	2.7	2.4	....	28....	115	19	3.0	2.5	2.4	....
14	....	22	3.7	2.7	2.4	....	29....	115	19	3.0	2.5	2.4	....
15	....	22	3.7	2.7	2.4	....	30....	113	19	3.0	2.5	2.4	....
							31....	....	19	....	2.5	2.4	....

Monthly discharge of Horseshoe Creek near Glendo, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 16-30	134	113	122	3,630
May	102	19	28.9	1,780
June	19	3.0	5.85	348
July	3.0	2.5	2.65	163
August	2.5	2.4	2.43	149
September 1-2	2.5	2.5	2.50	9.9
The period	....	....	....	6,080

Note.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by United States Reclamation Service.

COTTONWOOD CREEK NEAR WENDOVER, WYO.

Location.—Approximately in sec. 16, T. 27 N., R. 67 W., near mouth of creek, 1½ miles south of Wendover, in Platte County.

Drainage area.—150 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 19 to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 92 second-feet from Cottonwood Creek, all above the station.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Cottonwood Creek near Wendover, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	4.3	9.6	5.0	4.3	1.3	16....	....	4.9	7.2	3.7	0.9	1.7
2	......	4.3	8.5	4.3	4.3	1.3	17....	....	4.9	7.2	3.7	.9	1.7
3	......	4.1	8.5	4.3	4.3	1.7	18....	....	5.3	7.2	3.7	.9	1.7
4	......	3.8	8.5	4.3	4.3	1.7	19....	24	5.3	7.2	3.7	1.3	1.7
5	......	3.5	7.6	3.7	63	1.7	20....	24	5.3	7.2	3.7	.9	1.7
6	......	3.5	7.6	3.7	1.7	1.7	21....	24	5.3	7.2	3.7	.9	1.7
7	......	3.5	7.6	3.7	1.3	1.7	22....	20	5.3	6.3	3.7	1.3	1.7
8	......	3.8	7.6	3.7	1.3	1.7	23....	20	6.0	5.6	3.7	1.3	1.7
9	......	4.1	6.8	3.7	1.3	1.7	24....	14	6.8	5.6	3.7	1.3	2.0
10	......	4.3	5.3	3.7	.9	1.7	25....	11	6.8	5.6	4.3	1.3	2.0
11	......	4.3	5.3	3.7	.9	1.7	26....	8.0	12	5.0	4.3	1.3	2.0
12	......	4.3	150	3.7	.9	1.5	27....	6.8	11	5.0	4.3	1.3	2.0
13	......	4.6	16	3.7	.9	1.5	28....	5.6	11	5.0	4.3	1.3	2.0
14	......	4.9	9.0	3.7	.9	1.7	29....	5.3	11	5.0	4.3	1.3	2.0
15	......	4.9	7.2	3.7	.9	1.7	30....	4.6	11	5.0	4.3	1.3	2.0
							31....	....	11	....	4.3	1.3	....

Monthly discharge of Cottonwood Creek near Wendover, Wyo., for the year ending Sept. 30 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 19-30	24	4.6	13.9	33
May	12	3.5	5.97	36
June	150	5.0	11.9	70
July	5.0	3.7	3.94	24
August	63	.9	3.55	21
September	2.0	1.3	1.73	10
The period				1,97

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from records o daily flow furnished by United States Reclamation Service.

LARAMIE RIVER AT GLENDEVEY, COLO.

LOCATION.—In sec. 36, T. 10 N., R. 76 W., at highway bridge one-eighth mile west of Glendevey, in Larimer County. Stub Creek enters a short distance below gage, and Nunn Creek just above.

DRAINAGE AREA.—102 square miles (measured on Clason's sectional map of Colorado, edition of 1911).

RECORDS AVAILABLE.—June 24, 1904, to October 31, 1905; August 18, 1910, to September 30, 1916. 1914 and 1915 records published only by State engineer.

GAGE.—Bristol water-stage recorder on downstream side of right abutment.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders and sand. Control is boulder riffle just below bridge.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.55 feet at 6 p. m. May 31 (discharge, 475 second-feet); minimum discharge probably occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—There are court decrees for diversions of 49 second-feet from Laramie River above station; total from the tributaries entering above not known, but of those decrees, 688 second-feet is for diversions into the Cache la Poudre basin. During 1916 a total of 27,470 acre-feet were diverted into the Cache la Poudre. In addition there is a conditional decree for diversion of not exceeding 1,235 second-feet through Laramie-Poudre tunnel. Diversion through tunnel in 1916 was 3,645 acre-feet.

REGULATION.—None.

COOPERATION.—Complete records furnished by State engineer.

Discharge measurements of Laramie River at Glendevey, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 16	Robert Follansbee	3.08	313
Aug. 16	Thomas Grieve, jr	2.20	57

discharge, in second-feet, of Laramie River at Glendevey, Colo., for the year ending Sept. 30, 1916.

	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
		114	360	180	70	42	16	42	180	272	80	51	36
		102	324	166	70	36	17	51	152	289	80	70	31
		80	324	152	80	42	18	60	139	299	80	70	31
		80	360	126	80	42	19	60	152	289	80	51	36
		114	378	139	80	31	20	42	194	255	80	42	31
		166	342	114	80	36	21	51	208	255	80	42	36
		223	306	114	80	31	22	60	194	208	80	36	42
		238	324	114	80	31	23	70	180	180	80	36	42
		223	378	102	80	42	24	80	238	180	80	36	51
		208	397	102	80	102	25	102	252	180	80	36	42
	60	208	378	91	80	60	26	126	255	180	80	42	36
	51	208	378	91	60	70	27	139	238	180	80	51	31
	51	194	378	80	42	60	28	166	289	166	80	42	42
	42	194	342	80	42	51	29	180	306	208	80	31	60
	51	194	289	80	42	42	30	139	360	208	60	42	60
							31		378		60	60	

discharge of Laramie River at Glendevey, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
11-30	180	42	81.2	3,220
	378	80	202	12,400
	397	166	287	17,100
	180	60	95.8	5,890
	80	31	57.5	3,540
ber	102	31	44.2	2,630
The period				44,800

LARAMIE RIVER NEAR JELM, WYO.

CATION.—In sec. 15, T. 12 N., R. 77 W., at highway bridge at Boswell's ranch, one-fourth mile below Colorado-Wyoming line, 4 miles south of Jelm, in Albany County. Stuck Creek enters 1 mile upstream.

AINAGE AREA.—293 square miles (measured on base map of Wyoming; scale, 1:500,000).

CORDS AVAILABLE.—May 7, 1911, to September 30, 1916. From June 22, 1904, to October 31, 1905, a station was maintained at Decker's ranch, one-half mile south of the State line. The records at the two stations are comparable, as there are no tributaries or diversions of any account between them.

AGE.—Bristol water-stage recorder on downstream side of right bridge abutment.

CHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

ANNEL AND CONTROL.—Bed composed of gravel. Control a short distance downstream; practically permanent. Left bank is overflowed at gage height 3.0 feet. Flow passes through three well-defined high-stage channels.

TREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet May 10 (discharge, 1,500 second-feet); minimum discharge occurs during winter months.

E.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

VERSIONS.—Between this station and that at Glendevey, Colo., there are court decrees for diversions of 236 second-feet from Laramie River and 204 second-feet from intervening tributaries. These diversions are all in Colorado.

GULATION.—None.

OPERATION.—Station maintained in cooperation with State engineer of Colorado, and records published as furnished by that office. Some discharge measurements made by engineers of United States Geological Survey.

Discharge measurements of Laramie River near Jelm, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 11	C. C. Hezmalhalch	1.30	103
June 16	Robert Follansbee	2.77	800
Aug. 17	Thos. Grieve, jr.	1.45	129

Daily discharge, in second-feet, of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	58	80	185	1,050	330	145	90
2	88	58	80	185	990	310	110	70
3	78	67	80	170	880	250	110	60
4	67	67	60	200	930	215	110	60
5	67	67	70	215	1,050	215	120	60
6	58	67	70	310	990	185	100	60
7	49	67	70	555	785	185	120	60
8	67	67	70	785	830	170	100	52
9	67	67	70	880	990	170	80	52
10	49	67	80	1,500	1,110	170	132	170
11	49	67	100	625	990	158	110	132
12	49	67	100	625	930	158	100	120
13	58	88	110	555	990	120	100	145
14	58	78	110	555	880	120	120	110
15	67	88	110	555	830	145	110	90
16	67	99	100	400	785	170	90	80
17	67	88	100	430	830	120	100	80
18	78	99	110	430	830	120	110	70
19	78	110	110	375	700	120	90	60
20	78	....	100	460	660	100	80	60
21	88	....	100	520	590	90	80	70
22	88	....	110	460	555	90	80	70
23	99	....	110	350	520	80	80	60
24	88	....	132	375	555	90	70	110
25	67	....	158	490	555	80	70	100
26	58	....	170	555	490	80	80	80
27	58	....	200	625	375	120	90	70
28	58	....	230	625	430	132	80	60
29	67	....	270	660	430	120	80	90
30	67	....	215	785	375	145	80	80
31	67	....	....	930	....	230	100	....

Monthly discharge of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	99	49	68.8	4,230
November 1-19	110	58	75.6	2,850
April	270	60	116	6,900
May	1,500	170	528	32,500
June	1,110	375	762	45,300
July	330	80	154	9,470
August	145	70	97.6	6,000
September	170	52	82.4	4,900

LARAMIE RIVER AND PIONEER CANAL NEAR WOODS, WYO.

Location.—In sec. 36, T. 14 N., R. 77 W., at diversion dam for Pioneer canal, 2 miles above Woods post office, in Albany County. Nearest important tributary, Fox Creek, enters 3 miles above.

Drainage area.—409 square miles (measured on base map of Wyoming; scale, 1: 500,000).

RECORDS AVAILABLE.—April 16, 1912, to September 30, 1916. The records for 1913 and 1914 were obtained by the Laramie Water Co. and published by the State engineer. From 1895 to 1900 and May 7 to November 11, 1911, a station was maintained at Woods Landing in sec. 11, T. 13 N., R. 77 W. The records are not directly comparable as Fox Creek enters between and a few small ditches divert water.

GAGE.—Bristol water-stage recorder, whose datum is crest of dam, was moved September 23, 1915, to upper wing wall of head gates, and although actually above canal intake, it still indicates flow over dam as it is in the pool formed by diversion dam. Gage originally at left end of dam just below Pioneer canal head gates. Chain gage on Pioneer canal is at the Johnson bridge 1½ miles below intake. Gage is read by W. H. McCumber.

DISCHARGE MEASUREMENTS.—Made from cable 2,000 feet above dam. Measurement of Pioneer canal made at Johnson bridge and this quantity is subtracted from flow at cable to determine flow at diversion dam.

CHANNEL AND CONTROL.—Channel at gage is pool formed by concrete diversion dam about 2 feet high. Control is dam and is permanent. Banks are high and not subject to overflow. Stage of zero flow, zero on gage. Bed of canal is composed of shale which changes somewhat; control not well defined.

EXTREMES OF DISCHARGE.—Laramie River: Maximum stage during year, from water-stage recorder, 1.9 feet for several hours, May 10 and June 13 (discharge, 980 second-feet); minimum stage (mean for day) 0.08 foot November 11 (discharge, 12 second-feet).

Pioneer canal: Maximum stage recorded, 2.18 feet at 4.35 p. m. June 30 (discharge, 119 second-feet); minimum discharge of about 2 second-feet occurs during winter when gates are closed.

ICE.—Stage-discharge relation not affected by ice as crest of dam is kept free from ice.

DIVERSIONS.—By decree of district court dated December 27, 1912, there were adjudicated diversions of approximately 10 second-feet from Laramie River between the State line and Pioneer dam, exclusive of the Pioneer canal, which has decrees for 282 second-feet.

REGULATION.—None, as pond above dam is too small to have any appreciable effect on flow. Whenever canal head gates are closed the discharge over dam increases.

ACCURACY.—Laramie River station: Stage-discharge relation permanent. Rating curve well defined below 400 second-feet, but somewhat uncertain above. Operation of water-stage recorder satisfactory except for short periods, as shown in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph. Records excellent except those for high water, which are good.

Pioneer canal station: Stage-discharge relation apparently permanent. Rating curve fairly well defined. Gage read to hundredths twice daily May 21 to June 30; once daily for remainder of period. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—The Laramie Water Co., through C. C. Schrontz, general manager, furnished gage-height record.

Discharge measurements of Laramie River near Woods, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 3	R. I. Meeker	0.28	44.4
May 19	H. K. Smith	1.11	440
June 17	Robert Follansbee	1.71	880

Daily discharge, in second-feet, of Laramie River near Woods, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	47	66	56	42	53	42	42	239	900	293	147	53
2	47	63	56	45	53	53	42	266	825	293	94	23
3	29	61	61	49	47	53	42	266	825	293	94	22
4	29	63	61	49	49	53	42	322	864	266	94	17
5	29	66	63	63	53	53	42	350	900	239	94	15
6	25	66	63	53	53	42	32	440	864	239	71	15
7	25	49	61	53	53	53	32	640	788	214	94	24
8	42	32	58	53	53	53	32	788	788	190	74	29
9	34	29	58	53	53	53	32	862	788	190	56	27
10	42	29	58	53	53	79	42	940	864	214	88	110
11	61	12	61	53	53	79	53	825	900	214	91	128
12	49	21	49	58	53	110	66	750	864	168	58	117
13	49	30	42	53	53	110	79	750	940	128	51	117
14	34	38	42	53	53	79	66	714	864	110	63	91
15	56	34	40	53	53	79	79	640	825	110	56	74
16	69	47	45	49	53	66	66	590	788	168	47	53
17	79	47	47	49	53	79	66	535	788	128	51	34
18	69	47	40	49	53	79	66	640	788	110	53	24
19	61	51	36	53	66	79	79	714	750	94	38	27
20	34	61	32	53	66	94	79	640	712	94	34	30
21	15	61	30	58	66	110	66	570	640	79	40	33
22	58	58	32	53	53	79	79	605	570	66	32	36
23	79	58	38	53	53	94	79	675	470	53	29	40
24	91	61	40	49	53	79	110	675	410	53	27	45
25	85	58	42	49	53	66	128	640	410	53	24	53
26	79	58	40	49	53	66	147	640	380	53	27	42
27	74	61	36	49	42	53	190	570	380	66	34	31
28	79	53	42	53	42	53	266	605	350	128	36	31
29	79	51	36	53	42	53	322	714	350	94	29	34
30	79	53	36	49	......	53	266	750	822	110	27	34
31	71	......	40	49	......	53	......	825	......	128	53	......

NOTE.—Discharge interpolated Nov. 12, May 16, 24, 25, July 31, Sept. 19–23, as gage was not read.

Monthly discharge of Laramie River near Woods, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	91	15	54.8	3,370
November	66	12	49.5	2,950
December	63	30	46.5	2,860
January	63	42	51.6	3,170
February	66	42	52.9	3,040
March	110	42	69.3	4,260
April	322	32	91.1	5,420
May	940	239	619	38,100
June	940	322	697	41,500
July	293	53	150	9,220
August	147	24	58.3	3,580
September	128	15	47.2	2,810
The year	940	12	166	120,000

Discharge measurements of Pioneer canal near Woods, Wyo., during the year ending Sept. 30, 1916.

Rate.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 3	R. I. Meeker	....	2.2
May 19	H. K. Smith	1.63	68
June 17	Robert Follansbee	2.09	106

Daily discharge, in second-feet, of Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	44	66	106	99	72	61
2	35	52	66	99	74	72	59
3	35	52	66	106	74	72	56
4	35	52	66	106	74	72	54
5	35	52	66	101	74	72	52
6	35	52	66	92	74	72	50
7	35	52	66	98	74	72	48
8	35	52	66	109	74	72	46
9	2	52	66	108	75	71	44
10	2	52	66	92	76	71	42
11	2	52	66	92	78	70	43
12	2	52	66	91	79	70	44
13	2	52	66	93	78	70	44
14	2	54	66	93	77	69	45
15	2	56	66	92	76	68	46
16	2	57	66	104	75	67	47
17	2	58	66	106	74	67	47
18	2	59	66	106	74	66	47
19	2	60	67	107	74	66	47
20	2	61	69	108	74	65	47
21	2	62	71	109	72	64	47
22	2	63	88	106	72	64	47
23	2	64	78	106	72	63	47
24	2	65	78	108	72	62	47
25	2	67	81	112	72	62	47
26	2	67	81	114	72	61	47
27	2	67	81	114	72	61	47
28	2	67	83	112	72	61	47
29	2	67	83	117	72	61	47
30	2	67	83	118	72	61	47
31	2	....	101	....	72	61	....

NOTE.—Discharge interpolated Apr, 7-9, 11, 12, 14, 16-24, 26 to May 17, 19, 20, July 3-7, 9-11, 13-17, 19-22, [illegible]-31. Aug. 2-5, 7-12, 14-25, 28-31, Sept. 2-9, 11-16, 18-23, 25-29, as gage was not read. Leakage through head gates estimated at 2 second-feet Oct. 12, 1915, to Mar. 29, 1916. Discharge Mar. 30-31, 46 second-feet.

Monthly discharge of Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	35	2	10.3	633
November			[a] 2.0	119
December			[a] 2.0	123
January			[a] 2.0	123
February			[a] 2.0	115
March			[a] 4.84	298
April	67	44	57.6	3,430
May	101	66	72.0	4,430
June	118	91	104	6,190
July	99	72	74.8	4,600
August	72	61	67.0	4,120
September	61	42	48.0	2,860
The year	118	2	37.2	27,000

[a] Estimated.

Combined monthly discharge of Laramie River and Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	93	17	65.1	4,000
November	68	14	51.5	3,060
December	65	32	48.5	2,980
January	65	44	53.6	3,300
February	68	44	54.9	3,160
March	112	44	74.1	4,560
April	389	84	149	8,870
May	1,010	305	691	42,500
June	1,030	440	801	47,700
July	392	125	224	13,800
August	219	86	125	7,690
September	171	65	95.1	5,660
The year	1,030	14	203	147,000

LARAMIE RIVER AT TWO RIVERS, WYO.

Location.—In sec. 5, T. 17 N., R. 74 W., at highway bridge at Two Rivers, in Albany County. Nearest tributary, Little Laramie River, enters one-fourth mile below.

Drainage area.—1,290 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1916. Station maintained by State engineer during 1913 and 1914.

Gage.—Bristol water-stage recorder on left bank just above bridge. Gage used since 1915 was referred to datum 0.74 foot higher than that of 1912. Gage on left bank 400 feet above bridge used during 1913 and 1914.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Bed composed of sand and gravel; shifting. No well defined control. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage, from water stage recorder, 3.45 feet at 1 p. m. June 9 (discharge, 566 second-feet); minimum discharge probably occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—By decree of district court dated December 27, 1912, there were adjudicated diversions of 414 second-feet from Laramie River between this and the station near Woods.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifting at high stages. Rating curve used October 1 to November 11 fairly well defined; curve used after June 20 not well defined. Operation of water-stage recorder fairly satisfactory except for periods when clock ran down, as shown in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph; shifting-control method used May 5 to June 12. Records good.

Cooperation.—Gage-height record furnished by Laramie Water Co., through C. C. Schrontz, general manager.

Discharge measurements of Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6	R. I. Meeker	[a] 1.98	38.9	July 8	H. K. Smith	1.61	119
Feb. 15	R. H. Fletcher	[a] 2.60	70	Apr. 17	do	1.20	53
May 5	Follansbee and Smith	1.41	106				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	88	113	....	386	180	67	75
2	54	107	....	410	150	83	....
3	46	97	....	446	120	75	....
4	44	80	....	470	110	67	....
5	45	86	60	446	120	60	....
6	45	86	53	350	130	48	....
7	43	84	42	386	120	75	....
8	36	84	53	434	110	53	....
9	24	80	92	482	96	60	....
10	20	75	182	446	90	60	....
11	21	97	272	386	100	70	....
12	28	....	362	434	112	83	....
13	42	....	350	450	100	48	....
14	50	....	266	465	90	42	....
15	54	....	266	480	78	38	....
16	61	....	314	492	75	30	....
17	77	....	338	502	104	38	....
18	80	....	362	450	98	42	....
19	89	....	374	400	96	33	....
20	97	....	326	338	92	12	....
21	97	....	314	326	101	21	....
22	99	....	310	183	101	56	....
23	107	....	300	218	92	92	....
24	89	......	350	266	83	60	....
25	93	......	315	254	75	75	....
26	97	....	278	242	75	48	....
27	99	....	338	266	53	75	....
28	103	....	362	278	48	83	....
29	103	....	398	230	42	67	....
30	103	....	434	205	48	48	....
31	99	....	446	....	55	75	....

NOTE.—Discharge estimated by comparison with record of flow of Laramie River near Woods May 10, 23-25, June 13-19, 30, July 1, 2, 9-19, 30, 31, Aug. 11, 22.

Monthly discharge of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	107	20	68.8	4,230
November 1-11	113	75	89.9	1,960
May 5-31	446	42	280	15,000
June	502	183	371	22,100
July	180	42	95.0	5,840
August	92	12	57.5	3,540

LARAMIE RIVER NEAR LOOKOUT, WYO.

Location.—About sec. 33, T. 21 N., R. 74 W., at steel highway bridge 9 miles northeast of Lookout, in Albany County. No tributary of importance between station and Wheatland reservoir No. 2, located a short distance downstream.

Drainage area.—2,100 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 22, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

Gage.—Bristol water-stage recorder on downstream side of right bridge abutment.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of sand and silt. Control a short distance downstream; shifts only at intervals, and practically permanent during 1916.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.1 feet at 6 p. m. June 17 (discharge, 681 second-feet); minimum discharge probably occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—By decree of district court dated December 27, 1912, there were adjudicated diversions of 211 second-feet from Laramie River between Two Rivers and the Lookout station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 20 and 700 second feet. Operation of water-stage recorder fairly satisfactory except for short periods as shown in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph. Records good.

Cooperation.—Gage-height record furnished by the Laramie Water Co. through C. C. Schrontz, general manager.

Discharge measurements of Laramie River near Lookout, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 4	Follansbee and Smith	1.72	100
June 15	Robert Follansbee	3.04	647
July 22	Follansbee and Hoyt	1.72	91

Daily discharge, in second-feet, of Laramie River near Lookout, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	....	91	317	189	60	34
2	35	....	130	360	173	60	34
3	51	....	130	430	158	80	34
4	48	....	104	482	158	189	38
5	44	....	80	455	158	297	42
6	49	....	80	430	143	116	46
7	49	....	80	455	143	104	50
8	51	....	104	508	143	91	60
9	51	....	116	482	158	80	60
10	49	....	189	430	130	80	50
11	44	....	277	430	130	80	60
12	35	....	360	508	130	91	60
13	34	....	382	563	130	80	60
14	35	....	382	592	143	91	69
15	42	....	382	592	130	80	91
16	50	....	382	621	130	69	91
17	60	....	360	621	116	69	69
18	75	....	317	621	114	60	69
19	80	....	297	592	111	60	52
20	90	....	297	651	109	60	34
21	95	....	277	592	106	60	27
22	105	....	240	508	104	50	34
23	114	....	244	430	91	50	34
24	106	....	248	360	91	42	27
25	109	....	251	317	80	42	27
26	106	....	254	258	69	50	20
27	104	60	258	158	69	42	20
28	104	60	277	189	69	42	20
29	109	69	297	143	69	42	27
30	109	91	297	158	69	34	34
31	104	....	297	....	69	34	....

Note.—Discharge estimated Oct. 16-22, May 23-26, July 18-21, Sept. 4-6, 19, by comparison with records of flow of Laramie River near Woods.

Monthly discharge of Laramie River near Lookout, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	114	28	69.8	4,290
April 27–30	91	60	70.0	555
May	382	80	241	14,800
June	651	143	442	26,300
July	189	69	119	7,320
August	297	34	76.9	4,730
September	91	20	45.8	2,730

LARAMIE RIVER BELOW McGILL, WYO.

LOCATION.—In sec. 33, T. 23 N., R. 73 W., at J. T. Dodge's ranch, 8 miles below McGill, in Albany County. No tributary between station and outlet of Wheatland reservoir No. 2.

DRAINAGE AREA.—2,230 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 4 to September 9, 1916.

GAGE.—Vertical staff on left abutment of private bridge; read by Mrs. Mary E. Dodge.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel. Control at small rapids 100 feet downstream.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.55 feet, June 16–17 (discharge, 652 second-feet); minimum discharge probably occurs during winter months.

ICE.—No information.

DIVERSIONS.—One small diversion between this station and that at McGill.

REGULATION.—Flow at station shows effect of storage in Wheatland reservoir which has an adjudicated decree for 633 second-feet and a storage capacity of approximately 110,000 acre-feet. Entire flow of Laramie River below Lookout passes through Wheatland reservoir.

ACCURACY.—Stage-discharge relation apparently permanent. Rating curve not well defined, being based on only three measurements. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

COOPERATION.—Gage-height record furnished by Laramie Water Co. through C. C. Schrontz, general manager.

Discharge measurements of Laramie River below McGill, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 4	Follansbee and Smith	0.65	[a]8
June 15	Robert Follansbee	2.43	560
Aug. 17	H. K. Smith	1.24	96

[a] Estimated.

Daily discharge, in second-feet, of Laramie River below McGill, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	....	492	615	88	25	16	344	652	367	107	....
2	....	479	580	128	14	17	467	652	300	107	....
3	....	492	544	128	14	18	479	630	260	107	....
4	10	531	544	70	10	19	479	615	209	38	....
5	10	544	544	....	5	20	358	615	209	25	....
6	7	512	544	....	2	21	344	622	179	14	....
7	98	544	512	....	2	22	450	615	166	5	....
8	249	544	479	....	1	23	479	615	147	25	....
9	329	615	450	....	1	24	479	615	138	25	....
10	344	615	479	....	....	25	479	615	128	25	....
11	367	645	479	....	....	26	580	615	124	25	....
12	320	622	420	....	....	27	492	615	88	53	....
13	320	372	420	128	....	28	486	615	111	38	....
14	320	378	394	107	....	29	512	580	115	38	....
15	320	590	394	103	....	30	492	615	72	38	....
						31	492	....	98	38	....

NOTE.—No record Aug. 5-12.

Monthly discharge of Laramie River below McGill, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 4-31	580	7	361	20,000
June	652	372	575	34,200
July	615	72	326	20,000

LARAMIE RIVER NEAR WHEATLAND, WYO.

Location.—In sec. 35, T. 25 N., R. 69 W., at highway bridge at Wheeler ranch, 10 miles northwest of Wheatland, in Platte County. Nearest tributary, Sibylee Creek, enters one-half mile below.

Drainage area.—2,480 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 13 to November 9, 1912; April 1, 1915, to November 10, 1916, when station was discontinued. State engineer maintained station at this point during 1913 and 1914.

Gage.—Chain gage on upstream side of bridge; read by John Wilkinson. During 1912 a staff gage on right bank 300 feet above bridge; no determined relation between gages.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of sand and gravel. Control 100 feet downstream at small rapids which form a pool at ordinary stages; permanent during 1916. Banks not subject to overflow. Stage of zero flow, about 0.2 foot.

Extremes of discharge.—Maximum stage recorded during year, 1.1 feet at 6 p. m. March 13 (discharge, 40 second-feet); minimum discharge practically zero during parts of August and September.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—By decree of district court dated December 27, 1912, there were adjudicated diversions of 14 second-feet from Laramie River between the station at McGill and this station. In addition, there is an adjudicated decree of 633 second-feet for storage in Wheatland reservoir (capacity about 110,000 acre-feet) above McGill. Water from this reservoir passes McGill but is diverted above the Wheatland station.

Regulation.—See diversions.

Accuracy.—Stage-discharge relation practically permanent after winter of 1915–16. Rating curve well defined below 40 second-feet. Gage read to quarter tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Cooperation.—Gage-height records furnished by Laramie Water Co. through C. C. Schrontz, general manager.

Discharge measurements of Laramie River near Wheatland, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	M. N. Grant, jr.	0.62	9.2	June 16	H. K. Smith	0.41	1.7
Apr. 4	R. H. Fletcher	.72	14.2	July 8	R. H. Fletcher	.40	[a] 1.0

[a] Estimated.

Daily discharge, in second-feet, of Laramie River near Wheatland, Wyo., for the period Oct. 1, 1915, to Nov. 10, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	13	10	....	17	10	6	3	2	0	2.0	6.0
2	10	10	....	18	9	6	2	2	0	2.2	6.0
3	10	10	....	18	9	6	2	1	0	2.8	6.4
4	9	10	....	12	10	5	1	1	0	3.8	6.0
5	10	10	....	12	7	2	2	1	0	4.0	6.0
6	8	10	....	12	4	2	2	1	0	4.0	6.0
7	9	10	....	14	3	2	2	1	0	4.0	6.4
8	10	10	....	12	3	1	2	0	0	4.0	6.4
9	10	10	....	11	2	2	2	0	0	6.0	6.0
10	9	10	....	11	2	2	2	0	0	6.0	6.4
11	8	10	....	12	2	4	2	0	0	6.0	....
12	9	6	31	12	4	9	3	1	1	6.0	....
13	10	6	34	12	7	9	3	1	0	6.0	....
14	10	6	34	12	14	7	2	1	0	4.0	....
15	10	7	25	12	10	2	2	1	1	6.0	....
16	16	7	20	14	8	2	2	1	1	6.0	....
17	17	7	18	14	8	2	2	0	1	6.0	....
18	16	7	18	13	8	7	2	0	1	7.2	....
19	15	7	24	11	9	12	2	0	1	7.6	....
20	12	7	25	11	18	14	2	0	1	7.6	....
21	11	8	31	12	23	13	2	0	1	8.0	....
22	11	9	31	11	18	8	1	0	1	8.0	....
23	10	10	19	10	16	4	1	0	1	10	....
24	10	9	24	10	16	3	1	0	1	10	....
25	10	8	20	8	12	3	1	0	1	10	....
26	10	7	14	9	10	3	1	0	1	9.0	....
27	10	8	14	10	8	4	0	0	1	9.0	....
28	10	7	16	10	8	3	1	0	2	7.6	....
29	10	7	25	8	7	2	2	0	2	7.2	....
30	10	7	25	10	6	3	2	0	2	7.2	....
31	10	....	20	....	6	....	2	0	....	6.4	....

Note.—Discharge estimated Nov. 13–22, 24, 25, 27–30, 1915, because of ice. Shifting-control methods used during open water, Oct. 1 to Nov. 30, 1915. Gage read, but data insufficient for estimates of flow, Nov. 11–18, 1916.

Monthly discharge of Laramie River near Wheatland, Wyo., for the period Oct. 1, 1915, to Nov. 10, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915-16.				
October	17	8	10.7	658
November	10	6	8.33	496
March	34	14	23.4	928
April	18	8	11.9	708
May	23	2	8.94	550
June	14	1	4.93	293
July	3	0	1.81	111
August	2	0	.45	27.7
September	2	0	.67	39.9
1916.				
October	10	2	6.25	384
November 1-10	6.4	6	6.16	122

LARAMIE RIVER AT FORT LARAMIE, WYO.

Location.—In sec. 28, T. 26 N., R. 64 W., at highway bridge at Fort Laramie, in Goshen County. No large tributary between station and mouth. 1½ miles below.

Drainage area.—4,580 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—April 4, 1915, to September 30, 1916.

Gage.—Vertical staff; read by Geo. Sandercock.

Discharge measurements.—Made from highway bridge.

Channel and control.—No information.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued.

Diversions.—By decree of district court dated December 27, 1912, there are adjudicated diversions of 47 second-feet between station near Laramie and Fort Laramie.

Regulation.—See Laramie River below McGill, page 221.

Cooperation.—Daily discharge records furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Laramie River at Fort Laramie, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	179	157	149	41	9.8	3.8	5.7
2	170	153	149	37	9.8	3.8	5.7
3	161	153	149	37	9.8	3.8	5.7
4	161	153	149	38	9.8	3.8	5.7
5	166	157	140	33	9.8	3.8	5.7
6	157	157	128	27	9.2	48.0	5.7
7	157	157	103	25	9.2	91.0	5.7
8	157	166	77	24	8.6	13.0	5.7
9	170	157	60	24	7.5	9.8	6.0
10	170	161	50	23	7.0	8.6	6.5
11	170	157	44	22	7.0	7.5	7.5
12	170	157	40	25	7.0	7.0	8.6
13	170	157	91	23	6.0	7.0	8.6
14	170	170	115	22	5.7	6.5	8.0
15	170	182	136	21	5.7	5.7	7.5
16	191	182	84	19	5.4	5.7	7.0
17	211	157	52	16	5.0	5.7	6.5
18	228	157	41	17	5.0	5.7	6.5
19	215	166	52	18	4.8	5.7	6.5
20	211	161	65	15	4.8	5.7	7.0
21	204	166	80	13	4.6	5.7	7.0
22	200	161	115	11	4.6	5.7	8.0
23	200	161	88	12	4.6	5.4	9.2
24	191	157	88	12	4.3	5.4	11.0
25	187	157	88	11	4.0	5.0	11.0
26	182	157	95	11	4.0	5.0	11.0
27	182	153	91	11	3.9	5.4	11.0
28	182	153	91	11	3.8	5.7	12.0
29	174	155	56	10	3.8	5.7	12.0
30	170	157	60	9.8	3.8	5.7	13.0
31	170		48		3.8	5.7	

Note.—Discharge estimated May 1 and Aug. 31.

Monthly discharge of Laramie River at Fort Laramie, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	228	157	181	11,100
November	182	153	160	9,520
May	149	40	89.5	5,500
June	41	9.8	20.6	1,230
July	9.8	3.8	6.20	381
August	91	3.8	10.1	621
September	13	5.7	7.90	470

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by United States Reclamation Service.

LITTLE LARAMIE RIVER NEAR FILMORE, WYO.

LOCATION.—In sec. 9, T. 15 N., R. 77 W., at private bridge at May's ranch, 1½ miles south of Filmore, in Albany County. No tributary of importance between station and junction of North, Middle, and South forks, 4 miles above.

DRAINAGE AREA.—155 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 14, 1911, to October 31, 1912; April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on downstream side of left bridge abutment; read by Claude May. Gage used since April 1, 1915, was referred to datum 0.21 foot lower than gage at same site used during 1911 and 1912.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders, No well-defined control. At high stages water flows through channel around right end of bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 7 a. m. June 10, 11, and 12 (discharge, 739 second-feet); minimum discharge, probably occurs during winter months.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated diversions of 43 second-feet from the Little Laramie above station and 255 second-feet from tributaries entering above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during winter period. Rating curve used October 1 to November 16 well defined; curve used after March 26 fairly well defined above 100 second-feet, but poorly defined below. Gage read to hundredths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Little Laramie River near Filmore, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	H. K. Smith	1.91	170
June 13	Robert Follansbee	3.04	585
July 8	H. K. Smith	1.72	130

Daily discharge, in second-feet, of Little Laramie River near Filmore, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	48	40	....	25	388	499	178	96	36
2	44	40	....	27	261	409	156	84	23
3	44	36	....	33	79	388	156	92	25
4	44	36	....	28	79	409	146	92	19
5	40	36	....	30	102	602	136	88	18
6	37	36	....	16	136	499	127	127	18
7	36	36	....	19	203	368	127	85	19
8	36	36	....	13	203	368	118	71	21
9	36	36	....	28	216	499	127	64	18
10	39	36	....	30	277	656	146	60	25
11	43	36	....	31	277	656	156	57	23
12	46	36	....	37	277	656	127	51	20
13	43	37	....	36	261	656	127	56	23
14	42	40	....	40	277	475	97	64	23
15	39	41	....	40	230	475	110	61	21
16	46	43	....	40	190	475	136	46	21
17	62	....	....	40	33	452	118	50	19
18	79	....	....	40	71	452	102	47	18
19	67	....	....	40	146	452	91	39	18
20	46	....	....	40	167	409	91	64	17
21	46	....	....	40	230	368	85	34	16
22	47	....	....	40	203	294	86	34	13
23	48	....	....	40	156	216	85	28	12
24	48	....	....	110	146	216	80	29	12
25	43	....	....	230	216	190	78	27	12
26	43	....	41	277	216	190	79	29	12
27	42	....	31	330	230	203	78	31	12
28	42	....	34	409	245	216	73	33	13
29	40	....	40	430	245	216	94	30	18
30	40	....	15	294	330	190	118	52	19
31	40	....	11	....	388	....	118	46	....

Monthly discharge of Little Laramie River near Filmore, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	79	36	45.0	2,770
November 1-16	43	36	37.5	1,190
March 26-31	41	11	28.7	342
April	430	13	94.4	5,620
May	388	33	209	12,900
June	656	190	405	24,100
July	178	73	114	7,010
August	127	27	57.0	3,500
September	36	12	18.8	1,120

LITTLE LARAMIE RIVER AT TWO RIVERS, WYO.

LOCATION.—On line between secs. 5 and 6, T. 17 N., R. 74 W., at highway bridge half a mile south of Two Rivers, in Albany County. No tributary between station and mouth, half a mile below.

DRAINAGE AREA.—310 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Bristol water-stage recorder located at bridge. Gage used during 1913 and 1914 was 400 feet downstream and was referred to different datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel which is fairly permanent. Control not well defined. Banks not likely to be overflowed, except during extremely high water.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 2.9 feet at 5 p. m. June 21 (discharge, 118 second-feet); minimum discharge occurs during irrigation season when there is little or no flow for extended periods.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions from Little Laramie River of 422 second-feet between this station and the one near Filmore; none below station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Operation of water-stage recorder fairly satisfactory until last part of July after which gage heights were of little value. Daily discharge ascertained by applying to rating table, mean daily gage height determined by inspecting gage-height graph. Records fair.

Cooperation.—Gage-height records furnished by Laramie Water Co., through C. C. Schrontz, general manager.

Discharge measurements of Little Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6	R. I. Meeker		0.8	May 5	Follansbee and Smith	1.53	3.6
Feb. 15	R. H. Fletcher	[a] 3.70	3.8	July 8	H. K. Smith	1.30	[b] 1.0

[a] Stage-discharge relation affected by ice. [b] Estimated.

Daily discharge, in second-feet, of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Jan.	Feb.	May.	June.	July.	Aug.
1	7				22	3.0	
2	6				39	2.0	
3	4				43	2.0	
4	3			3	43	2.0	
5	3			2	39	2.0	
6	3	0.8		2	32	1.0	
7	3			2	35	1.0	
8	3			2	32	.8	
9	3			3	25	.8	
10	3			3	22	.8	
11	3			4	28	.8	
12	4			4	32	.8	6
13	5			3	41	.8	5
14	10			5	49	.8	6
15	14		3.8	8	58	.8	5
16	23			6	67	.8	5
17	37			2	76	.8	4
18	38			2	84	.8	3
19	36			2	93	.8	3
20	32			1	102	.8	2
21	29			2	110	.8	2
22	26			2	74		2
23	22			2	52		3
24	16			2	39		2
25	7			3	28		2
26	4			3	22		2
27	3			3	17		2
28	2			5	10		2
29	1.3			5	8		2
30	1.0			8	5		2
31	.7			10			2

Note.—Discharge interpolated May 8-11, 23-25, June 13-20, and July 2, 14-19. Practically no flow July 21-31, and Sept. 9-19. No gage-height record Aug. 1-11, Sept. 1-8, and 20-30.

Monthly discharge of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	38	0.7	11.4	701
May 4-31	16	1	3.54	197
June	110	5	44.2	2,630
July	3	0	.78	48
August 12-31	6	2	3.10	123

SIBYLEE CREEK NEAR WHEATLAND, WYO.

Location.—In sec. 35, T. 25 N., R. 69 W., just above highway bridge half a mile above mouth and 10 miles northwest of Wheatland, in Platte County. No tributary between station and mouth.

Drainage area.—568 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—May 23, to November 4, 1912; April 1, 1915, to November 10, 1916, when station was discontinued. State engineer maintained station at this point during 1913 and 1914.

Gage.—Vertical staff on left bank 150 feet above bridge; read by John Wilkinson. Gage used in 1912 was on opposite bank and was referred to datum 1.15 feet lower.

Discharge measurements.—Made from single-span bridge, or by wading.

Channel and control.—Bed composed of sand and gravel. Control short distance downstream; slightly shifting. Banks not subject to overflow. Stage of zero flow, about 0.2 foot.

Extremes of discharge.—Maximum stage recorded during year, 1.55 feet at 7 a. m. May 12 (discharge, 148 second-feet); practically no flow during summer.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—By decree of district court dated December 27, 1912, there were adjudicated diversions of 187 second-feet from Sibylee Creek, and 35 second-feet from tributaries, all above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifting. Standard rating curve well defined; applied indirectly Mar. 12 to May 15. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Cooperation.—Gage-height record furnished by Laramie Water Co., through C. C. Schrontz, general manager.

Discharge measurements of Sibylee Creek near Wheatland, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	M. N. Grant, jr	0.60	11.3	June 16	H. K. Smith	0.40	2.8
Apr. 4	R. H. Fletcher	.88	49.1	July 8	R. H. Fletcher	.31	[a].6

[a] Estimated.

Daily discharge, in second-feet, of Sibylee Creek near Wheatland, Wyo., for the period Oct. 1, 1915, to Nov. 10, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.
1	7	10		53	17	2	0		2.0
2	6	22		45	15	3	0		2.0
3	6	17		55	11	2	0		1.8
4	7	18		55	8	2	1.2		1.8
5	7	18		46	5	14	.6		1.6
6	6	18		50	2	14	.8	0.1	2.0
7	7	17		52	2	8	1.0	.1	1.5
8	10	16		51	2	4	1.2	.2	1.6
9	10	18		50	5	4	.5	.2	1.5
10	10	18		45	33	2	.5	.2	2.0
11	10	18		47	27	[illegible]	.6	.2	
12	10	14	77	51	122	4	.8	.2	
13	10	18	77	51	70	5	.4	.2	
14	10	18	83	48	118	22	.4	.0	
15	10	18	68	46	53	8	.6	.2	
16	24	19	74	47	16	3	.6	.2	
17	28	20	65	42	11	1	.4	.1	
18	27	31	68	50	24	1	.4	.2	
19	25	20	68	46	18	5	.2	.2	
20	19	22	78	46	33	4	.2	.2	
21	19	27	94	47	64	2	.2	.2	
22	20	25	83	45	14	4	.2	.9	
23	20	25	68	40	13	2	.1	1.0	
24	20	27	72	46	29	2		1.1	
25	20	25	65	27	38	1		1.0	
26	20	25	52	24	27	2		1.2	
27	17	20	52	22	22	4		1.8	
28	17	24	52	22	27	2		1.6	
29	8	24	55	18	14	1		1.6	
30	6	24	58	17	8	1		1.8	
31	6		57		4			1.9	

Note.—Practically no flow July 1-3, and July 24 to Oct. 5, 1916, gage read Nov. 11-18, 1916, but owing to [illegible], data inadequate for determination of flow.

Monthly discharge of Sibylee Creek near Wheatland, Wyo., for the period Oct. 1, 1915, to Nov. 10, 1916.

Month	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915-16.				
October	28	6	13.6	836
November	31	10	20.5	1,220
March 13-31	94	52	68.3	2,710
April	55	17	42.7	2,540
May	122	2	27.5	1,690
June	22	1	4.27	254
July	1.2	0	0.35	21.5
August	.0	0	0.	0
September	.0	0	0.	0
1916.				
October	1.9	0	.54	33.2
November 1-10	2.0	1.5	1.78	35.3

NORTH LARAMIE RIVER NEAR WHEATLAND, WYO.

Location.—In sec. 2, T. 25 N., R. 70 W., one-fourth mile above headgate of North Laramie Land Co.'s ditch and 18 miles northwest of Wheatland, in Platte County. No tributary of importance within 10 miles of station.

Drainage area.—366 square miles (measured on base map of Wyoming; scale, 1:500,000).

Records available.—November 6, 1914, to September 30, 1916.

Gage.—Bristol water-stage recorder on vertical cliff on left bank just below site of proposed dam.

Discharge measurements.—Made from cable near gage or by wading.

Channel and control.—Bed composed of sand and gravel. Control 40 feet downstream at rapids; shifts somewhat.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 2.1 feet at 6 p. m., April 27 (discharge, 176 second-feet); stream practically dry after July 9.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 37 second-feet from North Laramie River above the station and 27 second-teet below.

Regulation.—None.

Accuracy.—Stage-discharge relation shifts between narrow limits. Rating curve fairly well defined below 150 second-feet. Operation of water-stage recorder fairly satisfactory until June 5, after which it failed to record correctly; water below gage after July 15. Discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph. Records fair.

Cooperation.—Gage-height records furnished by North Laramie Land Co.

Discharge measurements of North Laramie River near Wheatland, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	M. N. Grant, jr.	1.35	33.5	June 16	H. K. Smith	1.10	15.7
Apr. 4	R. H. Fletcher	1.55	76	July 8	R. H. Fletcher	.70	[a]1.5
5	do	1.60	84				

[a] Estimated.

Daily discharge, in second-feet, of North Laramie River near Wheatland, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.
1	45	8	2	85	145	88	6
2	45	8	2	80	135	106	5
3	40	8	4	79	125	96	5
4	40	8	6	71	115	88	4
5	40	11	4	63	115	79	3
6	35	8	1	79	106	71	3
7	30	6	2	71	115	66	2
8	35	4	....	63	106	60	2
9	30	4	....	71	106	55	....
10	22	4	....	88	96	49	....
11	22	6	....	125	88	44	....
12	11	18	....	145	79	38	....
13	8	6	....	135	79	32	....
14	11	4	....	135	79	27	....
15	11	2	....	135	71	22	....
16	18	6	....	155	79	16	....
17	18	4	....	155	96	15	....
18	14	6	....	155	135	14	....
19	14	8	....	155	106	14	....
20	14	6	....	155	88	13	....
21	18	6	....	155	96	12	....
22	30	6	....	156	79	12	....
23	35	8	....	145	79	11	....
24	30	6	....	145	79	10	....
25	18	4	....	155	79	10	....
26	14	8	....	155	79	9	....
27	14	12	....	106	79	9	....
28	8	1	....	155	71	8	....
29	11	0	....	155	71	7	....
30	14	1	....	155	71	7	....
31	11	....	....	....	79	....	....

Note.—Shifting-control method used Oct. 1 to Nov. 10. Discharge estimated Apr. 1, 2, June 7–15, 17–30, and July 1–7. Stream was almost dry for remainder of year. Observer reported considerable flow during March, but did not begin observations until Apr. 1.

Monthly discharge of North Laramie River near Wheatland, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ober	45	8	22.8	1,400
mber	18	0	6.20	369
mber 1-7	6	1	3.00	41.7
r.	166	63	125	7,440
[illegible]	145	71	94.4	5,800
[illegible]	106	7	36.3	2,160
[illegible]	6	2	3.75	59.5

CHUGWATER CREEK AT CHUGWATER, WYO.

ocation.—In sec. 31, T. 21 N., R. 66 W., at highway bridge half a mile from railroad station at Chugwater, in Platte County. No tributary within several miles.

Drainage area.—359 square miles (measured on base map of Wyoming; scale, 1:500,000).

ecords available.—May 22, 1911, to November 6, 1912; January 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

age.—Chain gage on left bank 300 feet above bridge; installed April 6, 1916, at same datum and site as vertical staff used previously; read by W. A. Taylor. Prior to February 6, 1912, gage was on bridge and referred to different datum.

harge measurements.—Made from highway bridge or by wading.

annel and control.—Bed composed of sand; shifted slightly during 1916; control not well defined. Banks high and not subject to overflow.

xtremes of discharge.—Maximum stage recorded during year, 2.5 feet March 20. 21, and 24 (discharge, 90 second-feet); minimum stage, 1.02 feet on August 17 and 18 (discharge, 2.5 second-feet).

e.—Stage-discharge relation not affected by ice.

versions.—Prior to December 31, 1916, there were adjudicated diversions from Chugwater Creek of 73 second-feet above the station and 98 second-feet below.

egulation.—None.

ccuracy.—Stage-discharge relation practically permanent except for one well-defined change March 20–24. Rating curve used before March 19 well defined, curve used after March 24 fairly well defined below 50 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used March 20–24. Records good.

Discharge measurements of Chugwater Creek at Chugwater, Wyo., during the year ending Sept. 30, 1916.

ate.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
3	M. N. Grant, jr.	1.67	33.4	June 17	H. K. Smith	1.18	4.8
15	R. I. Meeker	1.34	12.3	July 7	R. H. Fletcher	1.12	3.8
23	R. H. Fletcher	1.46	17.2	Sept. 3	P. V. Hodges	1.03	2.6
r. 6	do	1.80	29.8				

Daily discharge, in second-feet, of Chugwater Creek at Chugwater, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	27	30	21	14	13	16	31	13	4.9	3.1	2.8	2.6
2	26	30	20	15	13	14	31	12	4.9	3.1	2.7	2.6
3	26	30	23	14	13	21	31	13	4.9	3.1	2.7	2.7
4	26	30	25	14	14	25	30	10.4	4.9	3.1	2.7	2.7
5	26	30	27	14	14	39	20	11.0	4.9	3.1	2.7	2.6
6	26	30	26	13	13	21	31	7.8	4.9	3.0	2.7	2.6
7	26	30	22	13	14	20	31	7.8	5.3	3.0	2.6	2.6
8	26	30	21	13	14	30	31	6.6	4.9	2.8	2.6	2.6
9	26	30	21	15	16	36	31	5.3	4.9	3.0	2.6	2.6
10	26	30	22	16	21	36	29	5.3	4.9	3.0	2.6	2.6
11	26	26	21	13	19	36	29	5.3	5.1	3.0	3.0	2.6
12	26	20	21	12	19	36	31	5.3	5.1	3.0	2.8	2.7
13	26	20	17	13	19	44	48	5.3	5.3	3.0	2.6	2.6
14	26	19	20	13	20	44	40	5.3	5.1	3.0	2.6	2.6
15	32	10	20	14	21	52	41	5.3	4.9	2.8	2.6	2.6
16	42	25	17	14	21	52	38	5.3	4.9	2.8	2.6	2.6
17	40	20	14	13	29	50	33	5.3	4.9	2.8	2.5	2.6
18	40	20	13	13	25	54	32	5.3	4.9	2.8	2.5	2.6
19	40	23	13	13	27	52	29	5.3	4.9	3.1	2.6	2.6
20	40	34	14	13	27	76	29	9.4	5.1	3.1	2.6	2.6
21	36	23	16	13	30	78	23	12	4.9	3.0	2.6	2.6
22	36	27	23	13	25	66	19	9.4	4.9	2.8	2.6	2.6
23	33	26	25	13	27	63	15	7.3	4.9	2.7	2.6	2.6
24	33	26	23	13	27	90	17	6.6	4.9	2.8	2.6	2.6
25	33	26	12	13	26	38	19	5.8	4.8	2.7	2.6	2.7
26	33	19	14	14	22	40	24	5.6	4.8	2.7	2.6	3.0
27	33	20	14	13	21	30	26	5.3	4.6	2.8	2.6	3.0
28	33	15	14	13	20	30	18	5.3	4.2	2.8	2.6	3.0
29	33	15	14	13	18	31	14	5.3	3.9	2.8	2.6	3.0
30	33	25	14	13	......	31	15	5.3	3.9	2.8	2.6	3.1
31	33	......	15	13	......	31	......	4.9	......	2.8	2.6	......

NOTE.—Discharge estimated Dec. 16, May 14, July 28, 29, Aug. 12, Sept. 9, 10.

Monthly discharge of Chugwater Creek at Chugwater, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	42	26	31.2	1,920
November	34	10	24.6	1,460
December	27	12	18.8	1,160
January	16	12	13.4	824
February	30	13	20.3	1,170
March	90	14	41.4	2,550
April	48	14	28.2	1,680
May	13	4.9	7.16	440
June	5.3	3.9	4.85	289
July	3.1	2.7	2.92	180
August	3.0	2.5	2.64	162
September	3.1	2.6	2.68	159
The year	90	2.5	16.5	12,000

HORSE CREEK NEAR LA GRANGE, WYO.

LOCATION.—In SW. ¼ SW. ¼ sec. 34, T. 20 N., R. 61 W., 2 miles southeast of Wye-Cross ranch and 1½ miles northwest of La Grange, in Goshen County. Nearest tributary, Bear Creek, enters 2 miles below.

DRAINAGE AREA.—683 square miles (measured on base map of Wyoming; scale, 1: 500,000).

RECORDS AVAILABLE.—November 1, 1915 to September 30, 1916. From December 1, 1911, to December 31, 1912, fragmentary records are available for station at a point 1½ miles downstream.

GAGE.—Gurley water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from footbridge near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; may shift. Cont
below gage at small rapids; apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage affected by ice; maximum dis
104 second-feet, occurred at noon February 18; minimum stage, from wat
recorder, 0.75 foot at 10.30 p. m. July 12 (discharge, 5.5 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice except during short

DIVERSIONS.—Prior to December 31, 1916, there were adjudicated permits fo
sions of 1,163 second-feet from Horse Creek above station and 71 seco
below. In addition, there were permits for storage of 2,067 acre-feet abo
5,202 acre-feet below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by
short periods in January and February. Rating curve well defined b
second-feet. Operation of water-stage recorder satisfactory except for fe
in winter when ice interfered. Records excellent.

Discharge measurements of Horse Creek near La Grange, Wyo., during the year
Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.
		Feet.	*Sec.-ft.*			*Feet.*
Oct. 25	Fletcher and Whiting	1.50	50	Jan. 8	Fletcher and Whiting	1.58
[illegible]	.....do	1.26	33.6	8	.....do	1.40
[illegible]	.....do	1.38	42.6	Apr. 6	R. H. Fletcher	1.18
[illegible]	.....do	1.14	22.7	July 6	.....do	.78
[illegible]	.....do	1.49	50			

Daily discharge, in second-feet, of Horse Creek near La Grange, Wyo., for the year
Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	52	46	45	32	66	48	9	9	9	9
2	52	47	45	32	43	38	10	8	9	9
3	53	49	53	34	45	34	10	9	8	9
4	53	56	59	32	65	32	10	9	8	8
5	54	60	56	35	70	31	10	9	7	9
6	54	58	57	41	64	27	10	8	7	10
7	54	55	48	37	54	27	10	7	6	11
8	51	54	48	41	59	31	10	7	7	12
9	51	54	54	45	61	33	10	7	7	12
10	52	54	44	50	60	35	10	8	8	11
11	53	45	45	65	61	32	10	7	8	10
12	50	45	37	68	60	31	11	7	6	11
13	51	49	37	59	60	30	12	8	6	11
14	40	51	36	68	60	29	12	9	6	11
15	50	57	35	69	59	31	12	9	6	11
16	58	39	34	83	59	30	11	9	7	11
17	64	27	33	85	56	27	11	9	7	10
18	50	41	32	84	55	24	11	9	7	10
19	51	47	34	79	55	23	11	9	6	10
20	58	47	41	82	54	22	11	10	6	11
21	50	50	48	78	55	21	12	9	6	10
22	51	64	41	76	54	20	12	10	6	9
23	50	64	48	74	54	20	12	9	6	10
24	52	58	46	68	59	20	13	9	6	11
25	53	46	48	69	63	18	12	9	6	9
26	49	53	45	61	62	16	11	9	6	16
27	49	55	41	60	59	14	10	9	7	14
28	40	52	39	56	55	14	10	9	8	12
29	39	42	37	58	54	9	10	9	8	14
30	54	34	36	....	54	9	10	9	10	14
31	....	49	32	....	51	....	10	....	11	14

NOTE.—Discharge estimated Jan. 10-13, 15-17, 26-28, and Jan. 31 to Feb. 6, when stage-discharg
affected by ice; also estimated Apr. 9, May 14-19, and Aug. 5-7.

Monthly discharge of Horse Creek near La Grange, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November	64	39	51.2	3,050
December	64	27	49.9	3,070
January	59	32	43.0	2,640
February	85	32	59.3	3,410
March	70	51	57.6	3,540
April	48	9	25.9	1,540
May	13	9	10.7	658
June	10	7	8.60	512
July	11	6	7.13	438
August	16	8	10.9	670
September	15	10	13.7	816
The period				20,300

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

LOCATION.—In sec. 25, T. 7 S., R. 70 W., 300 feet below point where North Fork of South Platte enters at South Platte, in Jefferson County. No tributary between forks and station.

DRAINAGE AREA.—2,610 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—March 28, 1902, to September 30, 1916. Records at Platte Canyon and at Deansbury, a few miles below, extend back to 1887, with the exception of 1893 and 1894. The earlier records, 1887–1892, were taken by the State engineer, and the records from 1895 to 1896 were taken under the direction of the Denver Power & Irrigation Co.

GAGE.—Bristol water-stage recorder on right bank 300 feet below forks; in use since March 14, 1910. From March 28, 1902, to May 7, 1905, the gage was at the highway bridge. On May 7, 1905, gage was moved to its present site 150 feet below bridge. Datum of new gage probably somewhat different. Recording gage is referred to datum of gage established in 1905.

DISCHARGE MEASUREMENTS.—Made from cable near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and fine gravel; shifts. Control 150 feet downstream at well-defined rapids; shifts considerably at times. Banks high and not subject to overflow.

ICE.—Stage-discharge relation seriously affected by ice; monthly mean discharge estimated from records obtained few miles below by Denver Union Water Co.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 4.1 feet on June 15–16 (discharge, 1,130 second-feet); minimum discharge occurs during winter.

DIVERSIONS.—No water is diverted between this station and that on the North Fork at South Platte. Above the station there are court decrees for 85,600 and 80,000 acre-feet for Antero and Cheesman reservoirs, respectively; all of this water passes the gage before being diverted. There are also decrees for diversions of 1,075 second-feet from South Platte River, together with 3,326 second-feet and 46,000 acre-feet for a reservoir from tributaries above the station.

REGULATION.—Flow regulated to certain extent by Antero and Cheesman reservoirs on the South Platte, about 60 and 15 miles, respectively, above the forks.

ACCURACY.—Stage-discharge relation not permanent; shifts considerably at times; affected by ice during winter. Rating curves used as follows: October to December, well defined between 200 and 1,500 second-feet; March 7 to June 1, fairly well defined between 180 and 850 second-feet; June 3 to September 30, well defined between 75 and 400 second-feet, and fairly well defined to 1,000 second-feet. Operation of water-stage recorder continuous and fairly satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph. Records excellent for ordinary stages, good for high stages, and fair for extreme low water and for winter.

charge measurements of South Platte River at South Platte, Colo., during the year ending Sept. 30, 1916.

ate.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
16	R. H. Fletcher	1.77	149	May 23	Follansbee and Smith	3.75	740
19	W. R. King	a 2.51	133	June 1	H. K. Smith	3.00	445
[illegible]	....do	a 2.62	136	July 8	W. R. King	3.38	800
7	Thos. Grieve, jr	2.05	196	Aug. 1	H. K. Smith	3.85	1,000

a Stage-discharge relation affected by ice.

discharge, in second-feet, of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	432	252	174	74	182	252	438	408	980	347
	515	252	150	32	182	278	530	471	1,000	347
	452	235	139	53	182	265	645	714	1,080	327
	432	235	162	80	171	332	834	691	1,030	288
	432	235	174	108	182	525	906	622	956	252
	452	252	150	108	193	620	882	668	810	252
	310	270	150	38	193	581	786	714	762	234
	235	270	139	55	182	562	810	738	738	218
	310	290	150	55	216	562	882	762	691	218
	432	270	150	76	216	581	1,000	762	691	218
	452	252	150	76	216	562	956	810	668	269
	452	162	128	69	228	544	931	786	645	269
	452	118	128	76	240	525	1,000	645	645	269
	473	96	150	76	252	507	1,030	762	600	327
	515	365	150	62	240	472	1,080	762	556	347
	515	212	128	69	228	454	1,080	622	622	327
	494	217	145	69	216	472	980	600	668	269
	473	161	162	76	228	438	906	556	668	252
	473	185	139	62	228	421	714	578	691	234
	412	203	139	304	216	472	691	556	645	218
	370	188	188	360	216	562	668	492	645	234
	412	188	188	375	216	640	600	460	600	202
	412	174	162	332	216	740	556	429	578	202
	310	174	174	291	216	700	534	408	534	160
	270	162	139	252	228	640	513	408	556	110
	290	150	174	240	240	600	471	556	534	110
	310	188	150	228	252	544	408	534	513	98
	310	118	150	228	278	489	388	534	429	98
	290	162	174	216	278	454	408	612	388	110
	290	162	203	216	278	438	408	691	408	134
	270	....	174	204	....	438	....	834	368	....

—Discharge estimated Nov. 14–19, Mar. 1–6, and June 2 from hydrograph comparison with records ver Union Water Co. at Platte Canyon. Discharge interpolated Dec. 17 and July 22, 29. Record tinued Jan. 1 to Feb. 29. See footnote to table of monthly discharge.

thly discharge of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
ober	515	235	395	24,300
vember	365	96	207	12,300
cember	203	128	156	9,590
nuary	....	....	118	7,260
bruary	....	....	124	7,130
Mar	375	32	147	9,040
pril	278	171	220	13,100
ay	740	252	505	31,100
e	1,080	388	734	43,700
	834	408	619	38,100
st	1,080	368	668	41,100
ember	347	98	231	13,700
The year	1,080	....	345	250,000

—Mean discharge for January and February computed from records obtained by Denver Union er Co. at Platte Canyon by reducing them 1.4 per cent for difference in drainage area.

SOUTH PLATTE RIVER AT NORTH PLATTE, NEBR.

Location.—In sec. 9, T. 13 N., R. 30 W., at pile-bent bridge half a mile south of North Platte, in Lincoln County. No tributary between station and mouth, 4 miles below.

Drainage area.—Not measured.

Records available.—June 1, 1914, to September 30, 1915.

Gage.—Vertical staff fastened to pile bent of bridge; read once daily by Fred Spurrier.

Discharge measurements.—Made from bridge.

Channel and control.—Shifting sand.

Extremes of discharge.—Maximum stage recorded during year, 5.5 feet at 8.45 a. m. April 1 (stage-discharge relation probably affected by ice); minimum stage recorded,3.2 feet July 20, 21, 22, and 24 (discharge, 15 second-feet).

Winter flow.—Stage-discharge relation seriously affected by ice, observations discontinued during winter.

Diversions.—Before September 1, 1914, there were approved diversions of 362 second-feet from South Platte River between Julesburg and North Platte.

Regulation.—None.

Accuracy.—Results fair; sufficient discharge measurements have been made to define fairly well the changes in stage-discharge relation. Daily discharge for April 1-13, as published in Water Supply Paper 406, page 253, is believed to be seriously in error due to effect of ice on stage-discharge relation.

Cooperation.—Field data furnished by State engineer.

Discharge measurements of South Platte River at North Platte, Nebr., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 19	C. J. McNamara	3.90	1,250	July 9	D. P. Weeks, jr	3.55	288
May 7	do	4.40	3,770	23	do	3.30	83
June 9	do	4.35	3,060	Aug. 9	do	3.70	388
26	D. P. Weeks, jr	3.98	1,200	Sept. 7	M. M. Garrett	3.40	211

Daily discharge, in second-feet, of South Platte River at North Platte, Nebr., for the year ending Sept. 30, 1915.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		4,740	3,360	518	508	518	16	1,220	3,290	5,050	255	310	200
2		3,940	2,520	685	985	518	17	1,220	2,720	5,050	152	440	200
3		3,140	2,520	685	775	375	18	1,100	3,140	5,050	110	440	200
4		6,140	2,520	602	595	375	19	985	3,610	5,050	68	310	200
5		5,400	2,920	518	440	342	20	775	3,610	3,700	15	310	200
6		5,050	3,140	518	255	310	21	880	3,610	2,340	15	310	200
7		3,860	3,360	518	375	310	22	1,360	3,610	1,980	15	310	200
8		3,860	2,920	518	375	310	23	2,720	4,500	1,660	68	310	200
9		3,860	2,920	375	375	310	24	2,930	5,400	1,660	15	310	105
10		3,860	3,360	375	375	310	25	3,140	4,740	1,360	22	310	200
11		3,360	3,140	375	685	310	26	3,360	4,420	1,220	30	518	288
12		3,860	3,140	375	518	255	27	3,360	7,390	1,000	30	375	375
13		3,860	3,940	255	255	200	28	3,360	11,400	775	30	685	518
14	1,220	3,860	4,740	255	255	200	29	2,920	8,330	775	30	602	518
15	1,220	3,860	4,740	255	282	200	30	2,920	7,010	775	200	518	375
							31		5,750		30	518	

Note.—Discharge determined by indirect method for shifting control; discharge interpolated Apr. 18, 24, 25, May 2, 9, 16, 23, 30, June 6, 13, 20, 27, July 4, 11, 18, 25, Aug. 1, 8, 15, 22, 29, Sept. 5, 11, 19, 26; not determined Oct. 1 to Dec. 10. Gage height not recorded for days for which discharge was interpolated nor for Oct. 4, 11, 18, 25, Nov. 1, 8, 15, 22, 29, Dec. 6, and Dec. 11 to Mar. 31.

Monthly discharge of South Platte River at North Platte, Nebr., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 14-30	3,360	775	2,040	68,800
May	11,400	2,720	4,680	288,000
June	5,050	775	2,890	172,000
July	685	15	255	15,700
August	985	255	440	27,100
September	518	105	294	17,500
The period				589,000

LITTLE SOUTH PLATTE RIVER NEAR FAIRPLAY, COLO.

Location.—In sec. 26, T. 11 S., R. 77 W., at Twin Bridges, about 5 miles northwest of Antero reservoir and 12 miles south of Fairplay, in Park County, on road to Buena Vista.

Drainage area.—88 square miles.

Records available.—May 9 to September 30, 1916.

Gage.—Vertical staff and Bunger water-stage recorder on upstream side of old bridge.

Discharge measurements.—Made from bridge or by wading.

Cooperation.—Daily discharge records furnished by Van Sant-Houghton Co., engineers, of Denver.

Discharge measurements of Little South Platte River near Fairplay, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 9	M. E. Bunger	7.60	69.1	June 15	M. E. Bunger	7.93	114
27	do	7.50	58.2	July 15	do	7.38	39.3
31	M. N. Grant, jr	7.63	76.0				

Daily discharge, in second-feet, of Little South Platte River near Fairplay, Colo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May	June.	July.	Aug.	Sept.
1		92	85	98	30	16		109	44	50	30
2		89	98	50	28	17	57	106	39	44	29
3		98	98	32	26	18		112	50	44	28
4		105	92	26	26	19		112	39	45	27
5		122	86	26	26	20		106	34	39	26
6		126	64	27	28	21		109	34	39	26
7		122	64	30	27	22		98	34	34	26
8		123	71	29	26	23	78	90	26		24
9	71	129	85	26		24	92	81	27		22
10		143	78	25		25	85	82	34		21
11		126	82	26		26	92	82	44		20
12		133	92	44	40	27	98	77	57		20
13		154	79	44	37	28	98	86	57		20
14		126	64	44	34	29	85	64	57		23
15		109	44	44	32	30	78	71	71		24
						31	92		85		

Monthly discharge of Little South Platte River near Fairplay, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June 23–30	154	64	106	6,310
July	98	26	61.7	3,790

Note.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by Van Sant-Houghton Co., Denver. Data insufficient for determination of monthly discharge in May, August, and September.

MIDDLE FORK OF SOUTH PLATTE RIVER AT ALMA, COLO.

Location.—Approximately in sec. 13, T. 9 S., R. 78 W., at footbridge just east of Alma, in Park County.

Drainage area.—23.7 square miles.

Records available.—May 1 to August 15, 1916.

Gage.—Vertical staff attached to upstream side of bridge near right bank; read to half tenths twice daily by W. H. Powless.

Discharge measurements.—Made from bridge or by wading.

Cooperation.—Daily discharge records furnished by Van Sant-Houghton Co., engineers, of Denver.

Discharge measurements of Middle Fork of South Platte River at Alma, Colo., during the year ending Sept. 30, 1916.

[Made by M. E. Bunger.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 7	7.10	25.5
June 17	7.50	108
July 15	7.15	30.5

Daily discharge, in second-feet, of Middle Fork of South Platte River at Alma, Colo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1	17.5	41.2	49.0	137	16	30.5	108	35.5	....
2	17.5	49.0	35.5	58.8	17	17.5	108	42.2	....
3	17.5	49.0	35.5	49.0	18	17.5	108	35.5	....
4	17.5	49.0	30.5	58.8	19	15.2	108	35.5	....
5	17.5	68.5	25.5	166	20	17.5	108	25.5	....
6	17.5	49.0	25.5	68.5	21	17.5	68.5	17.5	....
7	21.5	35.5	25.5	35.5	22	17.5	49.0	17.5	....
8	17.5	35.5	25.5	30.5	23	7.2	49.0	17.5	....
9	25.5	49.0	35.5	30.5	24	17.5	49.0	17.5	....
10	30.5	108	30.5	30.5	25	21.5	49.0	17.5	....
11	21.5	88.2	35.5	25.5	26	17.5	49.0	17.5	....
12	21.5	108	49.0	25.5	27	17.5	49.0	25.5	....
13	25.5	137	35.5	35.5	28	25.5	108	25.5	....
14	30.5	108	30.5	108	29	25.5	58.8	25.5	....
15	35.5	88.2	30.5	49.0	30	35.5	58.8	88.2	....
					31	49.0	....	108	....

Note.—Discharge May 1–6 estimated.

Monthly discharge of Middle Fork of South Platte River at Alma, Colo., for they year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May	49.0	7.2	22.1	1,360
June	137	35.5	73.0	4,340
July	108	17.5	33.9	2,080
August 1-15	166	25.5	60.6	1,800
The period				9,580

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by Van Sant-Houghton Co., Denver.

MIDDLE FORK OF SOUTH PLATTE RIVER AT FAIRPLAY, COLO.

LOCATION.—Approximately in sec. 33, T. 9 S., R. 77 W., at bridge on road to the south of Fairplay, in Park County.

DRAINAGE AREA.—83 square miles.

RECORDS AVAILABLE.—October 17, 1910, to July 6, 1912; May 1 to October 31, 1916.

GAGE.—Vertical staff on upstream side of right abutment; read to hundredths twice daily by G. H. Eaton.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

COOPERATION.—Daily discharge records furnished by Van Sant-Houghton Co., engineers, of Denver.

Discharge measurements of Middle Fork of South Platte River at Fairplay, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 6	M. E. Bunger	1.04	54.4	June 25	M. N. Grant, jr.	1.76	193
June 6	do	1.95	315	July 15	M. E. Bunger	1.65	164

Daily discharge in second-feet of Middle Fork of South Platte River at Fairplay, Colo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	51	182	254	386	85	53	16	77	365	175	175	72	53
2	51	182	224	254	77	53	17	88	365	203	136	68	53
3	51	190	224	203	77	51	18	88	449	190	129	64	51
4	51	285	224	216	74	51	19	91	417	175	124	68	43
5	51	236	190	417	72	51	20	91	417	155	114	64	35
6	55	165	182	216	72	51	21	88	285	155	114	62	33
7	108	136	182	190	64	51	22	96	254	175	104	62	43
8	120	165	216	190	64	51	23	81	190	175	101	62	49
9	124	203	224	175	64	51	24	88	190	136	101	62	46
10	148	254	216	148	72	51	25	104	190	129	101	62	51
11	148	301	182	129	88	51	26	108	285	129	91	60	51
12	136	417	254	148	91	51	27	96	301	182	91	57	43
13	136	495	190	190	88	51	28	104	301	175	88	57	46
14	124	417	190	254	81	51	29	108	301	148	85	57	51
15	104	301	175	190	72	31	30	136	273	449	85	57	43
							31	155		386	85		46

NOTE.—Discharge May 1-5 estimated.

Monthly discharge of Middle Fork of South Platte River at Fairplay Colo., for 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May	155	51	98.6	6,060
June	495	136	284	16,900
July	449	129	202	12,400
August	386	85	162	9,960
September	91	57	69.2	4,120
October	53	33	48.6	2,990
The period				52,400

NOTE.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by Van Sant-Houghton Co., Denver.

TARRYALL CREEK NEAR JEFFERSON, COLO.

LOCATION.—In sec. 6, T. 9 S., R. 74 W., at Robbins ranch, 10 miles southeast of Jefferson, in Park County. Rock Creek enters half a mile below.

DRAINAGE AREA.—223 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—June 27, 1912, to September 30, 1916. From October 18, 1910, to June 28, 1911, a station was maintained within a quarter of a mile of present site. Relation between the present gage and that used 1910–11 not known.

GAGE.—Vertical staff installed April 22, 1916, on left bank 60 feet above and at same datum as old staff on left bank opposite ranch house. Difference in gage heights of about 0.4 foot as read on new and old gages is due to fall in stream between them. Gage read by Miss Esther Robbins.

DISCHARGE MEASUREMENTS.—Made from footbridge 400 feet below gage, or by wading.

CHANNEL AND CONTROL.—Bed composed of fine gravel. Principal control 150 feet downstream at gravel bar; practically permanent during 1916. Banks subject to overflow at stage of 2.8 feet, and at 3.0 feet the entire bottom for a width of 500 feet is flooded.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.4 feet at 6 p. m. July 31 (discharge, 425 second-feet); minimum stage, −0.25 foot, May 29 (discharge, 1 second-foot).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—There are court decrees for diversions of 314 second-feet from Tarryall Creek above and 220 second-feet below station. The Tarryall Canal & Reservoir Co. has a provisional decree for storage of 68,000 acre-feet from Tarryall and tributaries above station, and a decree for a supply diversion (not yet made) amounting to 450 second-feet. There are decrees for diversions of 926 second-feet from tributaries entering above station. The Boreas ditch diverts a small amount of water from the headwaters of Blue River to Tarryall Creek at its headwaters.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve developed for gage used before April 22 fairly well defined between 25 and 370 second-feet; curve developed for new gage well defined between 20 and 65 second-feet and fairly well defined beyond these limits. Gage read to quarter tenths twice daily. Owing to high altitude of drainage basin (9,500 to 13,000 feet) considerable diurnal fluctuation is caused during spring by alternate melting and freezing, and mean daily gage height from morning and evening readings may be somewhat in error. Daily discharge ascertained by applying mean daily gage height to rating table. Records good for medium and fair for high and low stages.

Discharge measurements of Tarryall Creek near Jefferson, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 22	W. R. King	[a]0.34	21.2	July 14	Robert Follansbee	0.48	34.6
June 1	M. E. Bunger	.42	28.7	17	M. E. Bunger	.60	54
9	do	.60	54				

[a] New gage installed; old gage read —0.04 foot.

Daily discharge, in second-feet, of Tarryall Creek near Jefferson, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	49	23	20		19	25	21	12	312	38
2	38	22	22		23	24	39	44	110	39
3	42	23	22		21	26	36	36	80	37
4	38	23	22		23	64	32	51	190	29
5	32	23	23		21	59	71	43	120	37
6	31	23	23		21	37	83	44	120	36
7	27	29	26		22	32	68	36	102	44
8	26	28	28		19	26	71	23	180	36
9	27	23	28		21	28	68	12	88	38
10	27	29	28		22	36	62	23	71	31
11	28	24	24		22	25	54	39	62	44
12	30	22			24	26	68	170	51	34
13	30	16			25	24	48	110	94	32
14	35	14			24	13	62	54	94	36
15	33	11			23	9	68	44	80	29
16	37	18			21	24	25	50	62	32
17	29	18			24	11	36	62	71	28
18	28	23			21	6	48	41	72	34
19	26	23			21	5	58	65	64	37
20	27	23			19	6	44	41	68	29
21	27	24			19	50	51	41	58	26
22	26	23		68	22	92	43	37	54	36
23	24	23		56	27	58	37	41	58	37
24	24	23		49	32	28	25	36	57	32
25	24	23		37	28	11	26	26	59	18
26	24	23		28	24	4	23	26	57	16
27	23	23		34	25	2	24	52	52	26
28	23	23		34	25	1	23	58	54	27
29	23	23		29	31	1	25	38	58	18
30	23	22		28	29	2	22	170	54	18
31	23			25		8		375	59	

NOTE.—Stage-discharge relation affected by ice Nov. 22, and from Dec. 12 to Mar. 21.

Monthly discharge of Tarryall Creek near Jefferson, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	49	23	29.2	1,800
November	29	11	22.3	1330
December 1-11	28	20	24.2	528
March 22-31	68	25	38.8	770
April	32	19	23.3	1,390
May	92	1	24.6	1,510
June	83	21	45.4	2.700
July	375	12	61.3	3,770
August	312	52	87.5	5,380
September	44	18	31.8	1,890

ROCK CREEK NEAR JEFFERSON, COLO.

Location.—Approximately in sec. 5, T. 9 S., R. 74 W., at Robbins ranch, about 10 miles southeast of Jefferson.

Drainage area.—44 square miles.

Records available.—June 1 to August 19, 1916.

Gage.—Staff on bridge; read once daily by Roy Wright.

Discharge measurements.—Made by wading.

Cooperation.—Daily discharge records furnished by Van Sant-Houghton Co., engineers, of Denver.

Discharge measurements of Rock Creek near Jefferson, Colo., during the year ending Sept. 30, 1916.

[Made by M. E. Bunger.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 1	0.6	2.0
19	.55	1.4

Daily discharge, in second-feet, of Rock Creek near Jefferson, Colo., for the year ending Sept. 30, 1916.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	2.0	0.7	5.8	11	......	2.75	4.65	21	1.0	1.0	......
2	2.0	4.65	5.8	12	......	3.5	4.65	22	.4	2.0	......
3	......	3.5	9.4	13	......	2.0	5.8	23	.4	2.75	......
4	......	3.5	27.8	14	......	2.0	5.8	24	.7	2.0	......
5	......	3.5	17.0	15	......	3.5	5.8	25	1.0	2.75	......
6	......	3.5	5.8	16	......	3.5	4.65	26	.7	3.5	......
7	......	3.5	5.8	17	......	2.0	5.8	27	.7	3.5	......
8	......	2.0	17.0	18	......	1.5	5.8	28	.4	5.8	......
9	......	2.75	5.8	19	1.5	1.0	4.65	29	.4	5.8	......
10	......	2.75	5.8	20	1.0	1.0	......	30	.7	5.8	......
								31	......	17.0	......

Note.—Discharge June 3–18 estimated at 2.0 second-feet.

Monthly discharge of Rock Creek near Jefferson, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June	2.0	0.4	1.50	89.3
July	17.0	.7	3.39	208
August 1–19	27.8	4.65	8.08	305
The period	......	......	......	602

Note.—Monthly discharge computed by engineers of United States Geological Survey from records of daily flow furnished by Van Sant-Houghton Co., Denver.

NORTH FORK OF SOUTH PLATTE RIVER AT GRANT, COLO.

Location.—In sec. 9, T. 7 S., R. 74 W., at Grant, in Park County, 250 feet above mouth of Geneva Creek.

Drainage area.—51 square miles (measured on Forest atlas).

Records available.—July 18, 1910, to September 30, 1916.

Gage.—Vertical staff on left bank 250 feet above mouth of Geneva Creek; read by Mrs. M. McFarland, and Mrs. D. Eckhardt.

Discharge measurements.—Made from foot log near gage or by wading.

Channel and control.—Bed composed of gravel. Principal control about 20 feet below gage at small rapids; shifts slightly during high water.

ICE.—Stage-discharge relation seriously affected by ice; observations of stage discontinued during winter; discharge measurements made monthly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.4 feet at 6 p. m. June 12 (discharge, 85 second-feet); minimum discharge occurs during winter.

DIVERSIONS.—There are court decrees for diversion of 5.5 second-feet from the North Fork above station and 24 second-feet from tributaries entering above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; shifted slightly during high water in June. Rating curve used before June 9, well defined between 7 and 275 second-feet; curve used after June 12 based on discharge measurement made June 28. Gage read to quarter tenths twice daily. Owing to high altitude of station (8,570 feet) considerable diurnal fluctuation is caused at certain seasons of year by alternate melting and freezing, and the mean daily gage height from morning and evening readings may be somewhat in error. Discharge ascertained by applying mean daily gage height to rating table; shifting control method used June 10 to September 30. Records good.

Discharge measurements of North Fork of South Platte River at Grant, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 15	R. H. Fletcher	[a]2.20	8.0	Apr. 21	W. R. King	1.66	17.5
Jan. 18	W. R. King	[b]1.52	7.1	June 28	Robert Follansbee	2.07	47.7
Feb. 9	Do	[b]1.45	6.3				

[a] Stage-discharge relation affected by ice.
[b] Complete ice cover but water flowing free as ice was arched over stream.

Daily discharge, in second-feet, of North Fork of South Platte River at Grant, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	20	7	......	......	......	......	16	28	74	51	33	17
	19	5	......	......	......	......	12	30	74	46	25	17
	20	7	......	......	......	......	8	27	74	43	23	16
	19	7	......	......	......	......	13	28	78	41	30	12
	16	7	......	......	......	......	11	33	80	43	39	12
	14	7	......	......	......	......	11	30	68	41	32	12
	14	7	......	......	......	......	16	47	62	41	30	12
	13	7	......	......	......	......	12	55	62	43	30	12
	11	7	......	......	6.3	......	8	64	68	41	27	12
	13	8	......	......	......	......	9	66	72	41	25	14
	13	......	......	......	......	......	14	66	69	41	22	16
	7	......	......	......	......	......	13	68	79	41	25	16
	7	......	......	......	......	......	13	70	79	33	49	16
	12	......	......	......	......	......	12	66	79	33	33	16
	10	......	8	......	......	10	12	57	73	32	30	14
	10	......	......	......	......	19	14	52	73	32	27	12
	12	......	......	......	......	14	16	47	73	33	25	12
	12	......	......	7.1	......	13	16	47	73	27	23	12
	12	......	......	......	......	12	16	47	73	30	23	12
	12	......	......	......	......	14	17	52	70	30	23	12
	11	......	......	......	......	14	14	51	67	27	22	14
	12	......	......	......	......	12	17	49	61	27	19	9
	11	......	......	......	......	11	19	46	56	25	19	9
	10	......	......	......	......	13	23	46	56	23	22	14
	9	......	......	......	......	14	25	52	67	23	19	9
	9	......	......	......	......	14	30	52	56	23	19	9
	7	......	......	......	......	12	33	52	59	23	19	9
	7	......	......	......	......	12	41	57	53	23	19	9
	8	......	......	......	......	10	41	59	53	23	19	9
	10	......	......	......	......	12	30	66	53	41	17	9
	8	......	......	......	......	13	......	70	......	36	19	......

NOTE.—Stage-discharge relation affected by ice Nov. 11 to Mar. 14; observations of stage discontinued Nov. 28 to Mar. 14, data insufficient to determine discharge.

Monthly discharge of North Fork of South Platte River at Grant, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	20	7	11.9	732
November 1-10	8	5	6.90	137
March 15-31	19	10	12.9	434
April	41	8	17.7	1,050
May	70	27	51.0	3,140
June	80	53	67.8	4,030
July	51	23	34.1	2,100
August	49	17	25.4	1,560
September	17	9	12.5	744

NORTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

Location.—In sec. 25, T. 3 S., R. 70 W., one-third mile above railroad station at South Platte, in Jefferson County. No tributary between station and mouth at South Platte.

Drainage area.—449 square miles (measured on map in Hayden's Atlas).

Records available.—January 4, 1909, to September 30, 1910; April 1, 1913, to September 30, 1916.

Gage.—Inclined staff on left bank one-third mile above railroad station; read by Miss A. Vermillion from October to June, and by Mrs. M. Wallbrecht, from June to September.

Discharge measurements.—Made from cable 300 feet above gage or by wading.

Channel and control.—Bed composed of gravel and sand. Principal control a short distance below gage; shifting between narrow limits. Banks not subject to much overflow.

Ice.—Stage-discharge relation seriously affected by ice.

Extremes of discharge.—Maximum stage recorded during year, 3.07 feet at 10.30 a. m. May 11 (discharge, 448 second-feet); minimum discharge occurs during winter.

Diversions.—There are court decrees for diversion of 20 second-feet from North Fork between Grant and South Platte and 62 second-feet from intervening tributaries, exclusive of Geneva Creek. Small quantities of water are also diverted at various times for a number of small ice and fish ponds.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts occasionally during periods of high water and ice. Rating curve used October 1 to December 13 fairly well defined between 100 and 850 second-feet; curve used March 20 to September 30 well-defined between 35 and 425 second-feet. Gage read to half-tenths once daily to June 30, and twice daily after that date. Prior to June 30, one reading per day applied directly to rating table to ascertain discharge; thereafter, mean daily gage height was used. Records good except those for winter months which are only roughly approximate.

Discharge measurements of North Fork of South Platte River at South Platte, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16	R. H. Fletcher	[a] 2.13	46.1	May 23	Follansbee and Smith	2.60	284
Jan. 19	W. R. King	[a] 2.67	46.4	June 1	H. K. Smith	2.92	356
Feb. 10	do	[a] 2.67	48.2	July 8	W. R. King	2.31	187
Apr. 7	Thos. Grieve, jr	1.68	56	Aug. 1	H. K. Smith	2.79	334

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Fork of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	150	87	106	....	83	134	403	231	312	145
	150	87	70	....	83	183	348	231	246	129
	138	87	106	....	92	157	312	202	202	123
	138	87	70	....	75	170	348	202	231	112
	127	87	87	....	112	183	348	202	312	112
	127	87	127	....	92	202	312	188	312	112
	116	106	116	....	67	246	278	196	278	112
	116	106	106	....	46	134	246	202	231	112
	106	96	106	....	67	330	278	216	231	112
	106	70	116	....	75	422	312	202	216	112
	106	45	127	....	75	442	366	216	202	134
	106	45	106	....	92	384	330	216	188	145
	106	45	87	....	112	312	403	216	246	162
	116	70	....	....	112	348	392	183	330	145
	127	106	....	....	102	246	362	178	246	138
	138	127	....	....	112	246	370	178	216	123
	138	127	....	....	112	246	377	188	188	112
	138	127	....	....	123	231	366	188	175	112
	127	127	....	....	123	216	366	178	162	112
	127	127	....	83	123	246	330	152	175	112
	116	127	....	102	112	278	312	157	175	112
	116	106	....	83	102	312	295	152	157	112
	116	87	....	83	112	312	312	152	145	112
	116	87	....	75	134	272	278	145	157	112
	116	70	....	46	145	298	278	134	162	102
	106	70	....	59	157	366	262	138	162	96
	106	106	....	92	170	326	262	138	157	92
	96	45	....	75	183	305	262	134	157	92
	96	45	....	75	157	319	262	134	145	92
	96	70	....	67	157	298	246	202	152	92
	96	....	....	75	....	384	....	295	162	....

NOTE.—Stage-discharge relation seriously affected by ice Dec. 14 to Mar. 19. Shifting-control method used May 24 to June 17. Discharge Dec. 14–31, estimated 56 second-feet, and March 1–19, as 35 second-feet because of ice.

Monthly discharge of North Fork of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	150	96	119	7,320
November	127	45	88.6	5,270
December	127	....	75.2	4,620
January	....	....	[a] 49.6	3,050
February	....	....	[a] 50.2	2,890
March	....	....	50.8	3,120
April	183	46	110	6,550
May	442	134	276	17,000
June	403	246	321	19,100
July	295	134	185	11,400
August	330	145	207	12,700
September	162	92	116	6,900
The year	442	....	138	99,900

[a] Estimated on account of ice, by a study of gage heights, weather records, observer's notes, and discharge measurements.

GENEVA CREEK AT GRANT, COLO.

Location.—In sec. 9, T. 7 S., R. 74 W., at highway bridge at Grant, in Park County, 300 feet above mouth of creek.

Drainage area.—74 square miles (measured on map in Forest atlas).

Records available.—November 3, 1911, to September 30, 1916. From July 5, 1908, to November 3, 1911, a station was maintained at Sullivan's ranch, 3 miles above Grant. Except during the spring run-off the flow at the two points is practically the same.

Gage.—Vertical staff on right bank just below bridge; temporary vertical staff on downstream side of left abutment used December 15, 1915, to April 21, 1916; read by Mrs. M. McFarland and Mrs. D. Eckhardt.

Discharge measurements.—Made from single-span bridge or by wading.

Channel and control.—Bed composed of coarse gravel. Principal control 50 feet downstream at gravel bar; shift in control during high water in June, 1915; practically permanent during 1916. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 2.2 feet at 6 p. m. May 10 (discharge, 244 second-feet); minimum stage, 0.76 foot at 8 a. m. March 1 (discharge, 9 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

Diversion.—There is a court decree for diversions of 1 second-foot from Geneva Creek above station, and a temporary reservoir decree for 1,490 acre-feet from Geneva and Kerby creeks.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice from November to February. Rating curve well defined between 10 and 200 second-feet. Gage read to half tenths twice daily. Owing to high altitude of station (8,570 feet) considerable diurnal fluctuation is caused at certain seasons of year by alternate melting and freezing, and the mean daily gage height based on morning and evening readings may be somewhat in error. Discharge ascertained by applying mean daily gage height to rating table. Records good for spring months, and excellent for remainder of open-water season. A change in the stage-discharge relation for discharge below 70 second-feet was probably caused by the high water in June, 1915, as shown by discharge measurements made in 1916. Mean discharge for August, 1915, should be 10 per cent greater and that for September 25 per cent greater than figures published in Water-Supply Paper 406, page 260.

Discharge measurements of Geneva Creek at Grant, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 15	R. H. Fletcher	[a] 1.15	12.8	Apr. 21	W. R. King	1.18	30.9
Jan. 17	W. R. King	[a] .98	12.4	June 28	Robert Follansbee	1.78	111
Feb. 9	.....do	.86	10.9				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Geneva Creek at Grant, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	20	12	13	10	9	13	32	172	118	102	54
2	39	15	12	13	10	12	12	35	145	113	76	49
3	43	21	12	13	10	19	14	30	140	111	72	49
4	41	23	12	13	10	14	12	42	145	109	86	47
5	31	27	13	12	10	12	13	40	145	102	126	41
6	31	23	12	12	10	10	11	41	134	97	102	40
7	30	23	12	12	10	10	11	87	118	93	80	38
8	25	21	12	12	10	10	12	95	118	91	93	37
9	27	18	12	12	11	10	12	140	145	91	76	36
10	28	31	12	11	10	10	14	175	151	95	72	37
11	30	17	12	12	10	10	18	157	145	95	62	47
12	28	21	12	12	11	11	17	113	175	93	62	49
13	30	11	13	12	10	18	19	100	178	86	113	46
14	32	11	13	12	12	25	16	95	169	87	95	44
15	31	12	13	12	10	19	19	70	151	84	89	41
16	29	12	13	12	10	14	17	73	157	84	84	37
17	27	12	13	12	10	13	20	72	151	86	80	36
18	27	12	13	12	11	11	23	61	163	78	70	39
19	24	13	13	12	11	10	22	64	169	74	64	39
20	24	14	13	11	10	14	14	74	160	74	61	39
21	24	14	13	11	11	19	19	76	151	73	60	35
22	23	14	13	11	10	12	24	73	110	73	56	31
23	23	14	13	11	10	14	28	66	134	67	56	31
24	20	13	13	11	10	10	27	72	140	60	60	31
25	22	13	13	11	10	13	30	106	134	61	59	31
26	23	13	13	11	10	12	182	104	134	61	61	31
27	23	12	13	10	10	9	42	91	134	61	60	30
28	23	12	13	10	10	12	53	106	134	61	60	30
29	23	13	13	10	10	15	54	118	126	61	60	30
30	22	13	13	10	......	12	38	121	121	91	61	30
31	25	......	13	10	......	14	......	148	......	93	59	......

NOTE.—Stage-discharge relation affected by ice Nov. 14 to Feb. 8, and Apr. 7, 8; determination of discharge based on weather records, observer's notes, and discharge measurements.

Monthly discharge of Geneva Creek at Grant, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	43	20	27.9	1,720
November	31	11	16.3	970
December	13	12	12.6	775
January	13	10	11.5	707
February	12	10	10.2	587
March	25	9	13.0	799
April	182	11	26.9	1,600
May	175	30	86.4	5,310
June	178	118	146	8,690
July	118	60	84.6	5,200
August	126	56	74.7	4,590
September	54	30	38.5	2,290
The year	186	9	45.8	33,200

CLEAR CREEK NEAR GOLDEN, COLO.

Location.—In sec. 6, T. 4 S., R. 70 W., 1,000 feet below head gate of Golden ditch and 2 miles above Golden, in Jefferson County. Only important tributary between station and mouth, Ralston Creek, enters 12 miles below.

Drainage area.—About 380 square miles.

Records available.—December 4, 1908, to December 31, 1909; June 8 to September 24, 1911; January 26, 1912, to September 30, 1916.

Gage.—Lallie water-stage recorder on left bank 1,000 feet below head of Golden ditch.

Discharge measurements.—Made from cable near gage or by wading.

Channel and control.—Bed composed of coarse gravel and small boulders. Principal control 25 feet downstream at rapids; shifts occasionally through narrow limits. Creek flows in canyon; banks not subject to overflow.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter except for occasional discharge measurements.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 3.30 feet at 3 a. m. June 18 (discharge, 872 second-feet); minimum discharge occurs during winter.

Diversions.—There is a court decree for a diversion of 53 second-feet from the headwaters of Fraser River to the West Fork of Clear Creek, and approximately 832 acre-feet were diverted. Above the Golden station there is a court decree for a diversion of 26 second-feet by the Golden ditch. The diversion by this ditch at the head gate was about 7,110 acre-feet for 1916, as determined from estimates of flow by gate operator.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent but shifts through narrow limits. Mean rating curve well defined. Shifting-control method based on frequent discharge measurements used throughout entire year. Operation of water-stage recorder satisfactory except during winter period. Daily discharge ascertained by applying to rating table mean daily gage heights determined by inspecting gage-height graph. Records good.

Cooperation.—Gage-height record furnished by Farmers Reservoir & Irrigation Co.

Discharge measurements of Clear Creek near Golden, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	R. H. Fletcher	1.18	83	May 20	R. H. Fletcher	2.05	322
Jan. 14	Fletcher and King	a 1.91	42	June 21	H. K. Smith	3.08	746
Feb. 9	R. H. Fletcher	a 1.38	54	Sept. 8	do	1.59	185
Mar. 14	W. R. King	.96	51				

a Stage-discharge relation affected by ice.

Note.—The following measurements of the discharge of Golden ditch wer emade: Nov. 9, 13.1 second-feet; May 20, 25.2 second-feet; June 21, 30 second-feet; Sept. 8, 3.6 second-feet.

Daily discharge, in second-feet, of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	146	99	....	....	....	66	158	517	615	426	244
2	133	100	....	....	....	71	175	550	580	372	228
3	121	99	....	....	....	72	144	536	605	352	222
4	133	96	....	....	....	68	158	550	555	414	231
5	127	94	....	....	....	71	168	595	526	453	218
6	123	89	....	....	48	69	189	541	507	397	225
7	119	85	....	....	46	70	298	475	498	376	203
8	115	81	....	....	54	72	317	475	498	409	203
9	111	86	....	54	58	66	340	526	517	418	197
10	107	84	....	....	63	61	393	645	531	393	175
11	114	....	....	....	63	76	414	665	507	344	228
12	116	....	....	....	61	76	393	733	480	360	203
13	112	....	....	....	63	86	393	764	440	393	228
14	114	....	42	....	61	84	418	748	426	384	218
15	127	....	....	....	60	82	356	717	393	384	209
16	123	....	....	....	66	84	317	728	393	368	181
17	120	....	....	....	66	81	295	759	440	356	170
18	120	....	....	....	67	93	278	829	431	325	168
19	125	....	....	....	61	97	270	818	414	306	160
20	120	....	....	....	58	90	310	791	368	284	155
21	116	....	....	....	71	85	295	738	356	295	146
22	114	....	....	....	67	89	295	640	360	274	146
23	108	....	....	....	68	90	237	640	321	254	148
24	105	....	....	....	68	104	281	605	321	247	142
25	108	....	....	....	58	118	317	610	302	254	142
26	108	....	....	....	58	131	356	635	317	254	140
27	110	....	....	....	64	148	360	640	321	234	135
28	107	....	....	....	70	175	372	676	332	178	135
29	104	....	....	....	74	206	418	702	340	212	125
30	102	....	....	....	69	183	422	686	453	241	123
31	100	....	....	....	70	....	494	....	466	260	....

NOTE.—Stage-discharge relation seriously affected by ice Nov. 11 to Mar. 5; records discontinued except for occasional discharge measurements. Table shows entire flow of stream only when Golden ditch is not diverting water.

Monthly discharge of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	146	100	116	7,130
November 1–10	100	81	91.3	1,810
March 6–31	74	46	62.8	3,240
April	206	61	95.5	5,680
May	494	144	311	19,100
June	829	475	651	38,700
July	615	302	439	27,000
August	453	178	330	20,300
September	244	123	182	10,800

SOUTH BOULDER CREEK NEAR ROLLINSVILLE, COLO.

LOCATION.—In sec. 35, T. 1 S., R. 73 W., 1 mile west of Rollinsville, in Gilpin County. Nearest important tributary, Jenny Creek, enters 4 miles above.

DRAINAGE AREA.—39 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 10, 1910, to September 30, 1916.

GAGE.—Vertical staff spiked to tree on left bank, 500 feet above bridge, used June 2 to September 30, 1916; vertical staff on downstream side of right abutment used May 8 to June 1, 1916; vertical staff on upstream side of right abutment used prior to May 8, 1916; read by Miss Grace Grant.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control not well defined; shifts occasionally. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 2.08 feet at 5.30 p. m., June 17, and 5 p. m., June 19 (discharge, 300 second-feet); minimum discharge of 6 second-feet occurred for short periods during January and February, when stage-discharge relation was affected by ice.

Ice.—Stage-discharge relation affected by ice for short periods; discharge determined from gage heights, observer's notes, discharge measurements, and weather records.

Diversions.—No court decrees for diversion above station.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent; shifts occasionally through narrow limits. Rating curve used October 1 to May 7 fairly well defined between 5 and 240 second-feet; curve used May 8 to morning of June 1, fairly well defined, between 5 and 240 second-feet; curve used afternoon of June 1 to September 30 fairly well defined between 20 and 300 second-feet. Gage read to quarter tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of South Boulder Creek near Rollinsville, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	W. R. King	1.01	18.3	June 23	H. K. Smith	1.81	209
Jan. 27	T. J. Watkins	.75	8.6	Aug. 16	P. V. Hodges	1.28	44.2
May 8	W. R. King	[a] 1.81	119	Sept. 28	.....do	1.00	19.0
June 2	.....do	[b] 1.90	238				

[a] New gage installed on downstream side of abutment; old gage read 1.90 feet.
[b] Gage installed 500 feet above the bridge; gage installed May 8 read 2.10 feet.

Daily discharge, in second-feet, of South Boulder Creek near Rollinsville, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	27	15	9	8	6	9	19	45	198	205	106	26
2	26	14	7	8	6	9	21	43	239	188	91	29
3	25	15	7	9	6	10	19	47	239	188	100	26
4	24	15	8	10	7	10	19	47	239	188	106	25
5	23	13	8	10	8	10	19	48	239	168	103	23
6	22	13	9	9	9	9	19	55	239	151	100	23
7	21	14	10	9	10	10	19	67	230	151	85	21
8	20	13	10	9	10	10	19	96	239	168	76	21
9	22	12	11	10	9	10	20	119	239	140	63	21
10	22	13	11	9	9	12	19	132	239	123	58	21
11	18	18	10	8	9	12	23	146	273	117	42	23
12	16	23	9	7	9	14	23	146	273	106	50	23
13	22	16	9	7	8	18	23	132	273	103	48	20
14	19	21	10	7	9	14	25	132	273	91	58	19
15	21	14	9	8	9	26	25	132	273	100	53	17
16	24	18	9	7	9	19	25	119	273	94	48	17
17	22	18	8	6	9	19	25	108	273	106	42	20
18	19	16	8	6	9	21	30	98	273	100	40	19
19	20	15	7	7	9	22	30	91	273	79	33	17
20	20	12	9	8	9	21	29	98	273	58	42	17
21	22	16	10	8	9	24	30	98	273	58	30	17
22	16	19	11	10	9	24	31	98	256	60	29	17
23	18	13	12	10	8	23	31	96	239	48	30	17
24	18	16	10	9	8	18	37	98	222	48	29	19
25	16	13	10	10	10	19	40	119	222	50	27	17
26	16	13	7	9	9	19	42	132	239	58	32	17
27	15	12	7	8	9	19	47	132	205	58	29	21
28	12	11	8	7	9	23	47	132	222	58	29	19
29	13	10	7	7	9	19	39	146	222	63	27	19
30	15	10	7	7	......	18	39	146	222	110	29	17
31	15	......	7	7	......	19	......	165	......	120	26	......

Note.—Stage-discharge relation affected by ice Nov. 28-29, Dec. 4-6, 12-22, 27-31, Jan, 1. 7, 12-19, 28-31, and Feb. 1-4, 27-28; discharge determined by study of gage-height record, weather records, observer's notes, and discharge measurements. Discharge estimated Oct. 1, 2.

Monthly discharge of South Boulder Creek near Rollinsville, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	27	12	19.6	1,210
November	23	10	14.7	875
December	11	7	8.84	544
January	10	6	8.19	504
February	10	6	8.59	494
March	26	9	16.5	1,010
April	47	19	27.8	1,650
May	165	43	105	6,460
June	273	198	247	14,700
July	205	48	108	6,640
August	106	26	53.6	3,300
September	29	17	20.3	1,210
The year	273	6	53.2	38,600

MISCELLANEOUS MEASUREMENTS.

Measurements of the flow of streams in the Missouri River basin at points other than gaging stations are recorded in the following table:

Miscellaneous measurements in Missouri River drainage basin during the year ending Sept. 30, 1916.

Date.	Steam.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Sept. 2	Heart River	Missouri River	Mandan, N. Dak.		47
Aug. 30	Dogtooth Creek	Cannonball River	Near Timmer, N. Dak		2.2
Sept. 21	do	do	do		2.4
Oct. 30	Oak Creek	Grand River	Wakpala, S. Dak		4.0
Apr. 22	do	do	do		177
Aug. 29	do	do	do		1.6
Sept. 1	do	do	do		2.3
May 26	North Platte	Platte River	Pathfinder, Wyo.	5.53	4,320
26	Canyon Creek	North Platte River	Irvine's ranch, near Alcova, Wyo.	.68	1.7
May 4	Laramie River	do	Sec. 24, T. 22 N., R. 74 W., at McGill, Wyo.	1.08	[a] 8.0
June 15	do	do	do	2.98	553
17	do	do	do	1.86	86
May 26	Bear Creek	South Platte River	Morrison, Colo		80
July 20	Fall River	Big Thompson Creek.	Sec. 13, T. 5 N., R. 74 W., about 300 feet above Roaring River.		30.2
20	Roaring River	Fall River	Sec. 13, T. 5 N., R. 74 W., at mouth.		32.1

[a] Estimated.

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STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART VI. MISSOURI RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the monographs, bulletins, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great basin.
XI. Pacific basins in California.
XII. North Pacific slope basins, in three volumes:
    A, Pacific slope basins in Washington and upper Columbia River basin.
    B, Snake River basin.
    C, Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local office of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., Room 704 Journal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Chicago, Ill., 1404 Kimball Building.
Topeka, Kans., 25 Federal Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Tucson, Ariz., University of Arizona.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Austin, Tex., Capitol Building.
Holonlulu, Hawaii, 14 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director. United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,100 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Decsriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	....do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W47 to 52	Descriptions, measurements, gage heights, and ratings	1900.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
21 A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 251 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332	do	1912.
WS 351 to 362	do	1913.
WS 381 to 394	do	1914.
WS 401 to 414	do	1915.
WS 431 to 444	do	1916.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives by years and drainage basins the numbers of the papers on surface-water supply published from 1899 to 1916. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data from 1902 to 1916, for any station in the area covered by Part III are published in Water-Supply Papers 83, 98, 128, 169, 205, 243, 263, 283, 303, 323, 353, 383, 403, and 433, which contain records for the Ohio River basin for those years.

Numbers of water-supply papers containing results of stream measurements, 1899–1916.

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope basins (St. John River to York River).	South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	Ohio River basin.	St. Lawrence River and Great Lakes basins.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope basin in Oregon.
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332–A	332–B	332–C
1913	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914	381	382	383	385	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Gallatin River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific slope basins.

[g] Rating tables and index to Water-Supply Papers 47-52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables of monthly discharge for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Scioto River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page 3, and the records for large lakes are presented in order of streams around the rim of the lake.

PART VI. MISSOURI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams in the Missouri River basin are Red Rock Creek and Beaverhead and Jefferson rivers, which may be considered a continuous river forming the head of the Missouri; and, below the mouth of the Jefferson, Madison, Gallatin, Prickly Pear, Little Prickly Pear, Dearborn, Sun, Marias, Judith, Musselshell, Milk, Yellowstone, Muddy, Little Missouri, Cheyenne, Niobrara, Platte (including North Platte and South Platte), Kansas, Osage (Marais des Cygnes), and Gasconade rivers. These streams drain wholly or in part the States of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. xxix.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1916; period after a date indicates discontinuance. Tributaries are shown by indention.

Red Rock Creek (head of Missouri River) above Red Rock reservoir, near Monida, Mont., 1911; 1914–15.

Red Rock Creek below Red Rock reservoir, near Monida, Mont., 1911–

Red Rock Creek at Lima, Mont., 1907–1911.

Red Rock Creek at Red Rock, Mont., 1890.

Beaverhead River (continuation of Red Rock Creek) at Barratts, Mont., 1907–

Beaverhead River at Dillon, Mont., 1907.

Jefferson River (continuation of Red Rock-Beaverhead River) near Silverstar, Mont., 1910–1916.

Jefferson River at Sappington, Mont., 1894–1905.

Missouri River at Toston, Mont., 1890; 1910–1916.

Missouri River near Townsend, Mont., 1891–1901; 1903–4.

Missouri River at Canyon Ferry, Mont., 1889.

Missouri River near Craig, Mont., 1890–1892.

Missouri River at Cascade, Mont., 1902–1915.

Missouri River at Great Falls, Mont., 1897–1905.

Missouri River at Fort Benton, Mont., 1910–

Missouri River near Williston, N. Dak., 1905–1907.

Missouri River at Mannhaven, N. Dak., 1904.

Missouri River at Washburn, N. Dak., 1905.

Missouri River at Bismarck, N. Dak., 1904–5.

Missouri River at Kansas City, Mo., 1905–6.

Missouri River tributaries:
- Passamari River [Ruby Creek] near Alder, Mont., 1911–1914.
- Bighole River near Dewey, Mont., 1910–1913.
- Big pipestone Creek near Whitehall, Mont., 1910–11.
- Whitetail Creek near Whitehall, Mont., 1911.
  - Little Whitetail Creek near Whitehall, Mont., 1911.
- Boulder River:
  - Muskrat Creek near Boulder, Mont., 1912–1914.
- Gibbon River (head of Madison River) near Yellowstone, Mont., 1913–1916.
- Madison River near Yellowstone, Mont., 1913–
- Madison River near Norris. Mont., 1897–1905; 1910.
- Madison River near Red Bluff, Mont., 1890–1894; 1897–1902.
- Madison River near Three Forks, Mont., 1893–1897.
- Gallatin River near Salesville, Mont., 1895–1905; 1910–1913.
- Gallatin River near Bozeman, Mont., 1889–1891.
- Gallatin River at Logan, Mont., 1893–1905.
  - Middle Creek near Bozeman, Mont., 1895–96; 1898–1900; 1902–3.
- Crow Creek near Townsend, Mont., 1912–13.
- Crow Creek near Radersburg, Mont., 1901.
- Deep Creek near Townsend, Mont., 1910–1915.
- Prickly Pear Creek near Clancy, Mont., 1908–1916.
- Prickly Pear Creek at East Helena, Mont., 1908–1913.
  - Lump Gulch Creek near Clancy, Mont., 1908–1913.
  - Tenmile Creek near Rimini, Mont., 1915–
  - Tenmile Creek near Helena, Mont., 1908–
    - Sevenmile Creek at Birdseye, Mont., 1908–1913.
- Little Prickly Pear Creek near Marysville, Mont., 1909–1911; 1913–
- Little Prickly Pear Creek near Canyon Creek, Mont., 1909–1911; 1913–
  - Lost Horse Creek near Marysville, Mont., 1909–1911.
  - Marsh Creek near Marysville, Mont., 1909–1911.
  - Deadman Creek near Marysville, Mont., 1909–1911.
- Dearborn River near Clemons, Mont., 1908–1911.
  - Falls Creek near Clemons, Mont., 1908–1911.
- Smith River at Truly, Mont., 1905–1907.
- Sun River, North Fork of North Fork (head of Sun River), near Augusta, Mont., 1911–12.
- Sun River, North Fork, near Augusta,[1] Mont., 1889–90; 1903–
- Sun River at Fort Shaw, Mont., 1912–
- Sun River at Sun River, Mont., 1905–1912.
- Sun River near Great Falls, Mont., 1897.
  - South Fork of North Fork of Sun River near Augusta, Mont., 1911–12.
  - Floweree Big canal near Fort Shaw, Mont., 1912.
  - Willow Creek near Augusta, Mont., 1905–1911; 1912–
  - South Fork of Sun River at Augusta, Mont., 1904–
    - Smith Creek near Augusta, Mont., 1906–1912.
      - Ford Creek near Augusta, Mont., 1906–1912.
  - Crown Butte canal at Riebling, Mont., 1912.
  - Crown Butte canal near Simms, Mont., 1912.
  - Sun River canal near Sun River, Mont., 1912.
  - Sun River canal at Vaughn, Mont., 1912.
- Belt Creek near Belt, Mont., 1905–6.
- Highwood Creek near Highwood, Mont., 1905–6.

---

[1] Records for 1889–90 published at Sun River above Augusta, Mont.

Missouri River tributaries—Continued.

- Two Medicine River (head of Marias River) near Midvale, Mont., 1902–3.
- Two Medicine River at Family, Mont., 1907–
- Marias River near Shelby, Mont., 1902–1908; 1911–
    - Badger Creek near Family, Mont., 1907–
    - Birch Creek at Swift dam, near Dupuyer, Mont., 1913–
    - Birch Creek near Dupuyer, Mont., 1907–
    - Birch Creek at Nelson's ranch, near Dupuyer, Mont., 1914–
    - Birch Creek at Hall's ranch, near Dupuyer, Mont., 1913–1916.
    - Birch Creek at Robare, Mont., 1914–
        - Dupuyer Creek at Dupuyer, Mont., 1908–1912.
        - Dupuyer Creek near Valier, Mont., 1912–
    - Cut Bank Creek at Cut Bank, Mont., 1905–
    - Dry Fork of Marias River near Valier, Mont., 1911–1915.
    - Teton River at Strabane, near Belleview, Mont., 1904–1906; 1908–
    - Teton River near Chouteau, Mont., 1904–1906; 1913; 1915–
    - Spring Creek near Strabane, Mont., 1913.
        - Deep Creek at Frazier's ranch, near Chouteau, Mont., 1912.
        - Deep Creek near Chouteau, Mont., 1911–
            - Willow Creek near Chouteau, Mont., 1912–
    - Muddy Creek near Bynum, Mont., 1912–
        - Blackleaf Creek near Bynum, Mont., 1912–
- Judith River near Lewistown, Mont., 1910.
- Musselshell River, North Fork (head of Musselshell River), near Delpine, Mont., 1909–1911.
- Musselshell River, North Fork, near Martinsdale, Mont., 1907–1914.
- Musselshell River at Harlowton, Mont., 1907–
- Musselshell River at Shawmut, Mont., 1902–1907.
- Musselshell River at Lavina, Mont., 1906.
    - Checkerboard Creek near Delpine, Mont., 1909–1911; 1913–14.
    - South Fork of Musselshell River near Martinsdale, Mont., 1907–1914.
    - American Fork near Harlowton, Mont., 1907–1911; 1913.
        - Lebo Creek near Harlowton, Mont., 1907–1911; 1913.
    - Boxelder Creek:
        - Flatwillow Creek near Flatwillow, Mont., 1911–
- Milk River, South Fork (head of Milk River), near Browning, Mont., 1905–
- Milk River at international boundary, 1913–
- Milk River at Havre, Mont., 1898–
- Milk River at Chinook, Mont., 1897.
- Milk River at Malta, Mont., 1902–
- Milk River at Hinsdale, Mont., 1908–1914.
- Milk River near Vandalia, Mont., 1915–
    - North Fork of Milk River near Browning, Mont., 1911–12.
    - North Fork of Milk River near Kimball, Alberta, 1913–
    - Fort Belknap canal near Chinook, Mont., 1903–
    - Winter-Anderson canal near Chinook, Mont., 1906; 1908.
    - Lodge Creek[1] at Chinook, Mont., 1906–1908.
        - Reser ditch near Chinook, Mont., 1905–6.
        - West Fork ditch near Chinook, Mont., 1905–6.
    - Battle Creek[2] near Chinook, Mont., 1905–
        - Cook canal near Chinook, Mont., 1905–
        - Matheson canal near Chinook, Mont., 1905–

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[1] Formerly called West Fork of Milk River.

[2] Formerly called North Fork of Milk River.

- Missouri River tributaries—Continued.
  - Milk River tributaries—Continued.
    - Paradise Valley canal near Chinook, Mont., 1903–
    - Harlem canal near Zurich, Mont., 1903–
    - Agency ditch near Harlem, Mont., 1905–
    - Beaver Creek overflow near Bowdoin, Mont., 1903–1906; 1908–1912.
    - Beaver Creek near Saco (Ashfield), Mont., 1903–1906; 1908–1912.
    - Rock Creek near Hinsdale, Mont., 1905–1907; 1912–
      - Rock Creek canal near Hinsdale, Mont., 1905–1907.
    - Porcupine Creek at Nashua, Mont., 1908–
  - Little Porcupine Creek near Frazer, Mont., 1908–
  - Wolf Creek near Wolf Point, Mont., 1908–1914.
    - Wolf Point ditch at Wolf Point, Mont., 1909.
  - Poplar River near Poplar, Mont., 1908–
  - Big Muddy Creek near Culbertson, Mont., 1908–
  - Yellowstone River near Canyon Hotel, Yellowstone National Park, 1913–
  - Yellowstone River at Corwin Springs, Mont., 1910–
  - Yellowstone River near Horr, Mont., 1889–1893.
  - Yellowstone River at Livingston, Mont., 1897–1905.
  - Yellowstone River at Billings, Mont., 1904–5.
  - Yellowstone River at Huntley, Mont., 1907–1916.
  - Yellowstone River at Junction, Mont., 1906–7.
  - Yellowstone River near Glendive, Mont., 1897–1910.
  - Yellowstone River at Intake, Mont., 1911–
    - Big Timber Creek, North Fork (head of Big Timber Creek), near Big Timber, Mont., 1907–1911.
    - Big Timber Creek near Big Timber, Mont., 1912–
      - South Fork of Big Timber Creek near Big Timber, Mont., 1907–1911.
    - Boulder River near Contact, Mont., 1910–1916.
    - Boulder River near McLeod, Mont., 1912–1914.
      - East Fork of Boulder River near McLeod, Mont., 1907–1909.
      - West Fork of Boulder River near Bruffeys, Mont., 1904–1910.
      - West Fork of Boulder River at McLeod, Mont., 1907–1914.
    - Sweetgrass Creek above Melville, Mont., 1907–
    - Sweetgrass Creek below Melville, Mont., 1907–
    - Stillwater River near Nye, Mont., 1911–1913.
    - Stillwater River near Absarokee, Mont., 1910–1914.
      - Woodbine Creek near Nye, Mont., 1911–1913.
      - Rosebud Creek at Abarsokee, Mont., 1910–1914.
    - Clark Fork at Fromberg, Mont., 1905–1913.
    - Pryor Creek at Coburn, Mont., 1911–
    - Pryor Creek at Huntley, Mont., 1904–1916.
    - Wind River (head of Big Horn River) at Dubois, Wyo., 1910–1912.
    - Wind River near Wind River, Wyo., 1909.
    - Wind River at Riverton, Wyo., 1906–1908; 1911–12; 1915–
    - Big Horn River at Thermopolis, Wyo., 1900–1905; 1910–1912; 1915–
    - Big Horn River near Hardin, Mont., 1904–
      - Warm Spring Creek near Dubois, Wyo., 1911–12.
      - Horse Creek at Dubois, Wyo., 1910–1912.
      - Red Creek near Dubois, Wyo., 1909.
      - Dinwoody Creek near Crowheart, Wyo., 1909.
      - Meadow Creek near J. K. ranch, Wyo., 1909.
      - Willow Creek at J. K. ranch, Wyo., 1909.

- Missouri River tributaries—Continued.
  - Yellowstone River tributaries—Continued.
    - Big Horn River tributaries—Continued.
      - Bull Lake Creek near J. K. ranch, Wyo., 1909.
      - Dry Creek at Crowheart, Wyo., 1909.
      - Popo Agie River near Lander, Wyo., 1911–12.
      - Popo Agie River below Arapahoe, Wyo., 1906–1909; 1911–12; 1915–
        - Little Popo Agie River at Hudson, Wyo., 1907–1909; 1911–12; 1915–
        - Little Wind River at Fort Washakie, Wyo., 1908–9.
        - Little Wind River above Arapahoe, Wyo., 1906–1909; 1911–12; 1915–
          - North Fork of Little Wind River:
            - St. Lawrence Creek near Wind River, Wyo., 1909.
          - Trout Creek at Wind River, Wyo., 1909.
      - Owl Creek near Thermopolis, Wyo., 1910–1912; 1915–
      - No Wood Creek at Bonanza, Wyo., 1910–1912; 1915–
        - Tensleep Creek near Tensleep, Wyo., 1910–1912; 1915–
        - Paintrock Creek near Hyattsville, Wyo., 1912.
        - Paintrock Creek near Bonanza, Wyo., 1910–1912; 1915–
      - Greybull River near Meeteetse, Wyo., 1910–1912; 1915–
      - Greybull River at Meeteetse, Wyo., 1897–1903.
        - Wood River near Meeteetse, Wyo., 1910–1912; 1915–
      - Shell Creek at Shell, Wyo., 1915–
      - Shoshone River near Ishawooa, Wyo., 1915–
      - Shoshone River at Marquette, Wyo., 1896; 1903; 1905–1908.
      - Shoshone River at Cody, Wyo., 1902–1909.
      - Shoshone River at Corbett dam, Wyo., 1908–
      - Shoshone River at Lovell, Wyo., 1897–1899.
      - Soap Creek neat St. Xavier, Mont., 1911–
      - Rottengrass Creek near St. Xavier, Mont., 1911–
      - Little Horn River near Wyola, Mont., 1911–
      - Little Horn River near Crow Agency, Mont., 1905–6; 1911–
        - Prairie Dog ditch near Story, Wyo., 1903.
        - Lodgegrass Creek near Lodgegrass, Mont., 1911–
    - Tongue River near Dayton, Wyo., 1903; 1911–12.
    - Tongue River at Carneyville, Wyo., 1911–12; 1915–
      - Goose Creek at Sheridan, Wyo., 1895–1897; 1911–12; 1915–
        - Little Goose Creek at Sheridan, Wyo., 1896–7; 1911–12.
    - Powder River, South Fork (head of Powder River), near Kaycee, Wyo., 1911.
    - Powder River near Arvada, Wyo., 1915–
      - Middle Fork of Powder River near Kaycee, Wyo., 1911–12.
        - North Fork of Powder River near Kaycee, Wyo., 1911.
      - Clear Creek at Buffalo, Wyo., 1896–1900; 1902–1904; 1911–12.
      - Clear Creek near Buffalo, Wyo., 1911–12.
      - Clear Creek near Arvada, Wyo., 1915–
        - Piney Creek at Kearney, Wyo., 1902–1906; 1911–12; 1915–
          - Cruez ditch near Story, Wyo., 1903.
  - Muddy River near Williston, N. Dak., 1904–1909.
  - Little Missouri at Alzada, Mont., 1904–1906.
  - Little Missouri River near Alzada, Mont., 1911–
  - Little Missouri River at Camp Crook, S. Dak., 1903–1906.
  - Little Missouri River at Medora, N. Dak., 1903–1908.
  - Knife River near Broncho, N. Dak., 1903–
  - Painted Woods Creek near Washburn, N. Dak., 1909–10.
    - Turtle Creek near Washburn, N. Dak., 1909–10.

Missouri River tributaries—Continued.
- Heart River near Richardton, N. Dak., 1903–
- Apple Creek near Bismark, N. Dak., 1905.
- Cannonball River at Stevenson, N. Dak., 1903–1908; 1911–
- Grand River, North Branch (head of Grand River), at Haley, N. Dak., 1908–
- Grand River near Seim, S. Dak., 1904–1906.
- Grand River near Wakpala, S. Dak., 1911–
- Moreau [Owl] River near Bixby, S. Dak., 1904–1906.
- Cheyenne River at Edgemont, S. Dak., 1903–1906.
- Cheyenne River near Hot Springs [Cascade Springs], S. Dak., 1914–
- Cheyenne River near Wasta, S. Dak., 1914–15.
  - Beaver Creek near Edgemont, S. Dak., 1905–6.
  - Hat Creek near Edgemont, S. Dak., 1905–6.
  - Battle Creek near Hermosa, S. Dak., 1903.
  - Spring Creek near Rapid, S. Dak., 1903–1905.
  - Rapid Creek at Rapid, S. Dak., 1903–1906.
  - Boxelder Creek at Blackhawk, S. Dak., 1903–1905.
    - Corbin-Morse ditch at Rapid, S. Dak., 1906.
  - Elk Creek near Piedmont, S. Dak., 1903.
  - Belle Fourche River at Belle Fourche, S. Dak., 1903–1906.
  - Belle Fourche River near Belle Fourche, S. Dak., 1906; 1912–
    - Redwater River near Minnesela, S. Dak., 1903.
    - Redwater River at Belle Fourche, S. Dak., 1903–1906.
      - Spearfish Creek near Spearfish, S. Dak., 1903–1906.
      - Redwater ditch at Minnesela, S. Dak., 1904–1906.
    - Crow Creek near Belle Fourche, S. Dak., 1904.
    - Owl Creek near Belle Fourche, S. Dak., 1904.
    - Indian Creek near Belle Fourche, S. Dak., 1904.
- White River at Crawford, Nebr., 1897.
- White River near Interior, S. Dak., 1904–1906; 1911–
- White River near Westover, S. Dak., 1911–
  - South Fork of White River near Westover, S. Dak., 1912–
- Niobrara River near Valentine (Fort Niobrara), Nebr., 1897; 1899; 1901–1906.
- Niobrara River near Spencer, Nebr., 1908.
- Niobrara River near Lynch, Nebr., 1913–1915.
- Niobrara River at Niobrara, Nebr., 1902; 1910–1913.
  - Red Deer Lake (on Plum Creek) near Woodlake, Nebr., 1904–05.
- James River near Lamoure, N. Dak., 1903.
- Big Sioux River near Watertown, S. Dak., 1900–1903.
- Big Sioux River near Sioux Falls, S. Dak., 1900–1901.
  - Rock River at Luverne, Minn., 1911–1914.
- Grizzly Creek, continuation of Colorado Creek (head of North Platte River) near Hebron, Colo., 1904–05.
- North Platte River near North Gate, Colo., 1915–
- North Platte River near Hebron, Colo., 1904–5.
- North Platte River near Cowdrey, Colo., 1904–5.
- North Platte River near Pinkhampton, Colo., 1904.
- North Platte River at Saratoga, Wyo., 1903–1906; 1909; 1911–12; 1915–
- North Platte River above Pathfinder, Wyo., 1913–
- North Platte River at Pathfinder, Wyo., 1905–
- North Platte River at Alcova, Wyo., 1904–5.
- North Platte River near Douglas, Wyo., 1894.
- North Platte River near Orin Junction, Wyo., 1894–1900.
- North Platte River at Guernsey, Wyo., 1900–1908; 1912.

- Missouri River tributaries—Continued.
  - North Platte River and Interstate canal at Whalen, Wyo., 1909–
  - North Platte River near Fort Laramie, Wyo., 1887–1890.
  - North Platte River at Henry, Nebr., 1912–1916.
  - North Platte River near Mitchell, Nebr., 1901–1913.
  - North Platte River at Scottsbluff, Nebr., 1912.
  - North Platte River near Gering, Nebr., 1897–1900.
  - North Platte River near Camp Clark, Nebr., 1896–1900.
  - North Platte River at Bridgeport, Nebr., 1902–1906; 1915.
  - North Platte River at North Platte, Nebr., 1895–1915.
  - Platte River near Lexington, Nebr., 1902–1906.
  - Platte River near Elm Creek, Nebr., 1914–15.
  - Platte River near Columbus, Nebr., 1895–1915.
  - Platte River near Freemont, Nebr., 1913–1915.
  - Platte River near Leshara, Nebr., 1911–1913.
  - Platte River near South Bend Nebr., 1903.
    - Little Grizzly Creek at Hebron, Colo., 1904–5.
    - Roaring Fork of North Platte River near Hebron, Colo., 1904–5.
    - North Fork of North Platte River at Higho, Colo., 1904–5.
    - Middle Fork of North Platte River:
      - Michigan Creek near Walden, Colo., 1904–5.
      - Michigan Creek near Cowdrey, Colo., 1904–5.
    - Canadian River at Cowdrey, Colo., 1904–5.
    - Douglas Creek near Keystone, Wyo., 1912; 1914–1916.
    - Mullen Creek near French, Wyo., 1911.
    - Big Creek near Big Creek (Downington), Wyo., 1911–12; 1915–
    - French Creek near French, Wyo., 1911–12; 1915–
    - Brush Creek near Saratoga, Wyo., 1911–12; 1915.
    - Encampment River near Peryam's ranch, Wyo., 1900.
    - Encampment River at Encampment, Wyo., 1911–12; 1915–
    - Cow Creek near Saratoga, Wyo., 1911–12.
    - Spring Creek near Saratoga, Wyo., 1911–12.
      - North Spring Creek near Saratoga, Wyo., 1913–1915.
    - Jack Creek at Matheson's ranch, near Saratoga, Wyo., 1913–
    - Jack Creek at Blydenburg's ranch, near Saratoga, Wyo., 1912.
    - Jack Creek at Burdick's ranch, near Saratoga, Wyo., 1911–12.
    - Pass Creek near Walcott, Wyo., 1911.
    - Medicine Bow River near Medicine Bow, Wyo., 1901; 1911–12; 1915–
      - Rock Creek near Arlington, Wyo., 1911–
      - Rock Creek near Rock River, Wyo., 1911–12.
        - Deep Creek near Arlington, Wyo., 1914–
      - Little Medicine Bow River:
        - Muddy Creek near Shirley, Wyo., 1915–
    - Sage Creek above Pathfinder reservoir, Wyo., 1915–
    - Sand Creek above Alcova, Wyo., 1915–
    - Sweetwater River near Splitrock, Wyo., 1902–3.
    - Sweetwater River near Alcova, Wyo., 1913–
      - Horse Creek near Alcova, Wyo., 1915–
    - Canyon Creek near Alcova, Wyo., 1915–
    - Bates Creek near Casper, Wyo., 1916–
    - Deer Creek at Glenrock, Wyo., 1916–
    - Boxelder Creek near Careyhurst, Wyo., 1911; 1916–
    - La Prele Creek near Fetterman, Wyo., 1916.
    - Wagon Hound Creek near La Bonte, Wyo., 1916–

- Missouri River tributaries—Continued.
  - Platte River tributaries—Continued.
    - La Bonte Creek near La Bonte, Wyo., 1916–
    - Horseshoe Creek near Glendo, Wyo., 1916–
    - Cottonwood Creek near Wendover, Wyo., 1916–
    - Laramie River at Glendevey, Colo., 1904–5; 1910–1913; 1916–
    - Laramie River near Jelm, Wyo., 1904–5; 1911–
    - Laramie River near Woods Landing, Wyo., 1895–1900; 1911.
    - Laramie River and Pioneer canal near Woods, Wyo., 1912; 1914–
    - Laramie River at Two Rivers, Wyo., 1911–
    - Laramie River near Lookout, Wyo., 1915–
    - Laramie River at McGill, Wyo., 1915.
    - Laramie River below McGill, Wyo., 1916–
    - Laramie River near Wheatland, Wyo., 1912; 1915–16.
    - Laramie River near Uva, Wyo., 1895–1900; 1903.
    - Laramie River at Fort Laramie, Wyo., 1915–
      - McIntyre Creek near Gleneyre, Colo., 1904–5.
      - Little Laramie River near Hatton, Wyo., 1902–3.
      - Little Laramie River near Filmore, Wyo., 1911–12; 1915–
      - Little Laramie River near Laramie, Wyo., 1903.
      - Little Laramie River at Two Rivers, Wyo., 1911–
      - Sibylee Creek near Wheatland, Wyo., 1912; 1915–16.
      - North Laramie River near Wheatland, Wyo., 1912; 1914–
      - North Laramie River at Uva, Wyo., 1911–12.
      - Chugwater Creek at Chugwater, Wyo., 1911–12; 1915–
    - Horse Creek near Little Horse Creek, Wyo., 1911–12.
    - Horse Creek near La Grange, Wyo., 1911–12; 1915–
    - Birdwood Creek near Sutherland, Nebr., 1913–1915.
    - South Platte River at Lake George, Colo., 1910–1915.
    - South Platte River at Cheeseman Lake, Colo., 1899; 1901.
    - South Platte River above North Fork, at South Platte, Colo., 1905–1912.
    - South Platte River at South Platte, Colo., 1902–
    - South Platte River near Deansbury (Platte Canyon), Colo., 1887–1892; 1895–1900; 1903.
    - South Platte River at Denver, Colo., 1895–1906; 1909–1913.
    - South Platte River near Kersey, Colo., 1901–1903; 1905–1913.
    - South Platte River near Orchard, Colo., 1895–1900.
    - South Platte River at Julesburg, Colo., 1902–1906; 1908–1914.
    - South Platte River near Big Spring, Nebr., 1902–3.
    - South Platte River at North Platte, Nebr., 1914–1915.
      - Little South Platte River near Fairplay, Colo., 1916–
      - Middle Fork of South Platte River at Alma, Colo., 1916.
      - Middle Fork of South Platte River at Fairplay, Colo., 1910–1912; 1916–
      - Tarryall Creek near Como, Colo., 1911–12.
      - Tarryall Creek near Jefferson, Colo., 1910–
      - Tarryall Creek near Hayman, Colo., 1910–1912.
        - Jefferson Creek at Jefferson, Colo., 1910–1912.
          - Michigan Creek near Jefferson, Colo., 1910–1912.
        - Rock Creek near Jefferson, Colo., 1916–
      - Goose Creek near Cheeseman Lake, Colo., 1899.
      - North Fork of South Platte River at Grant, Colo., 1910–
      - North Fork of South Platte River at Cassells, Colo., 1908–1913.
      - North Fork of South Platte River at South Platte, Colo., 1909–10; 1913–
        - Geneva Creek above Jackwhacker Creek, near Grant, Colo., 1909–1911.

- Missouri River tributaries—Continued.
  - Platte River tributaries—Continued.
    - South Platte River tributaries—Continued.
      - North Fork of South Platte River at South Platte, Colo.—Continued.
        - Geneva Creek at Old Geneva smelter, near Grant, Colo., 1909–1911.
        - Geneva Creek at Sullivan's ranch, near Grant, Colo., 1908–1911.
        - Geneva Creek at Grant, Colo., 1911–
          - Smelter Creek at Old Geneva smelter, near Grant, Colo., 1909–1911.
          - Duck Lake Creek near Grant, Colo., 1909–1911.
          - Scott Gomer Creek at Sullivan's ranch, near Grant, Colo., 1909–1913.
      - Bear Creek near Morrison, Colo.,[1] 1888–1891; 1895–1902.
      - Clear Creek at Idaho Springs, Colo., 1910–1912.
      - Clear Creek at Forkscreek, Colo., 1899–1912.
      - Clear Creek near Golden, Colo., 1887–88; 1908–9; 1911–
      - St. Vrain Creek at Lyons, Colo.,[1] 1888–1892; 1895–1903; 1909–1913.
        - Boulder Creek at Orodell, Colo.,[2] 1887–1890; 1907–1913.
        - Boulder Creek near Boulder, Colo.,[1] 1888–1892; 1895–1901; 1907–1909.
          - South Boulder Creek near Rollinsville, Colo., 1910–
          - South Boulder Creek at Eldorado Springs (near Marshall), Colo., 1888–1892; 1895–1901; 1909–1913.
            - Community canal near Marshall, Colo., 1909.
      - Big Thompson Creek near Arkins, Colo.,[1] 1888–1892; 1895–1911.
        - Handy ditch near Arkins, Colo., 1899–1900; 1903.
      - Cache la Poudre River near Elkhorn, Colo., 1909–1911.
      - Cache la Poudre River near Fort Collins, Colo., 1909–1911.
      - Cache la Poudre River at mouth of canyon near Fort Collins, Colo., 1884–1901; 1910–1913.
      - Cache la Poudre River near Greeley, Colo., 1903.
      - Crow Creek:
        - Middle Fork of Crow Creek near Hecla, Wyo., 1902.
    - Middle Loup River (head of Loup River) near St. Paul, Nebr., 1895; 1897; 1899; 1903.
    - Loup River at Columbus, Nebr., 1894–1915.
      - North Loupe River near St. Paul, Nebr., 1895; 1897; 1899; 1903.
    - Elkhorn River at Norfolk, Nebr., 1896–1903.
    - Elkhorn River at Arlington, Nebr., 1899–1903; 1913–1915.
    - Elkhorn River at Waterloo, Nebr., 1911–1913.
  - Republican River, North Fork (head of Kansas River), near Haigler, Nebr., 1896.
  - Republican River, North Fork, near Benkelman, Nebr., 1894–95; 1903–1906.
  - Republican River at Culbertson, Nebr., 1913–1915.
  - Republican River at Bostwick, Nebr., 1904–1915.
  - Republican River near Superior, Nebr., 1896–1903.
  - Republican River at Junction, Kans., 1895–1905.
  - Kansas River near St. George, Kans., 1904.
  - Kansas River near Topeka, Kans., 1904.
  - Kansas River at Lecompton, Kans., 1899–1906.
  - Kansas River near Lawrence, Kans., 1895–1899.
    - South Fork of Republican River at Benkelman, Nebr., 1894–95; 1903–1906.
    - Frenchman Creek near Wauneta, Nebr., 1895–96.

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[1] Published only in Water Supply Paper 74.

[2] Published as "North Boulder Creek above Boulder" in Thirteenth Ann. Rept., pt. 3.

- Missouri River tributaries—Continued.
  - Kansas River near Lawrence, Kans.—Continued.
    - Frenchman Creek near Palisade, Nebr., 1894–1896.
    - Frenchman Creek at Culbertson, Nebr., 1913–1915.
    - Smoky Hill River at Ellsworth, Kans., 1895–1905.
    - Smoky Hill River at Solomon, Kans., 1904.
      - Beaver (Ladder) Creek near Scott City, Kans., 1904–5.
      - Saline River near Beverly, Kans., 1895–1897.
      - Saline River near Salina, Kans., 1897–1903.
      - Solomon River at Beloit, Kans., 1895–1897.
      - Solomon River near Niles, Kans., 1897–1903.
    - Big Blue River (head of Blue River) at Beatrice, Nebr., 1910–1915.
    - Blue River at Manhattan, Kans., 1895–1905.
      - Little Blue River at Blue Bluff, Nebr., 1912.
      - Little Blue River near Fairbury, Nebr., 1908–1915.
  - Osage (Marais des Cygnes) River at Ottawa, Kans., 1902–1905.
  - Gasconade River at Arlington, Mo., 1903–1906.
    - Piney Fork of Gasconade River near Houston, Mo., 1908–1909.
    - Piney Fork of Gasconade River near Hooker, Mo., 1903. (Also called Big Piney Creek.)
    - Little Piney Creek near Arlington, Mo., 1903.

REPORTS ON WATER RESOURCES OF THE MISSOURI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

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Treats of topography, rainfall, and water supply in the valley of Cache la Poudre River, a tributary of the South Platte; describes the canals and reservoir system, construction and operation of canals, and agricultural practice; discusses also the legislative and judicial control of the waters; speaks of the use of the underground water, effect of alkali waters on soil, pumping of underground waters, and artesian wells.

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*23. Water-right problems of the Bighorn Mountains, by Elwood Mead. 1899. 62 pp., 7 pls. 10c.

Discusses water divisions, districts, appropriations, reservoirs, and administrative questions.

*29. Wells and windmills in Nebraska, by E. H. Barbour. 1899. 85 pp., 27 pls. 15c.

Describes home-made windmills; discusses briefly action of water underground, transmission and storage of windmill power, precipitation, surface waters for irrigation, supply for cities and towns, salt water, and blowing wells.

*34. Geology and water resources of a portion of southeastern South Dakota, by J. E. Todd. 1900. 34 pp., 10 pls. 10c.

Describes areas in Turner, Hutchinson, Bonhomme, Yankton, and Clay counties, including typical sections of the valleys of James and Vermilion rivers.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along rivers of the United States, including Missouri, Jefferson, Bighole, Beaverhead, Madison, Gallatin, Osage, Kansas, Republican, Platte, Yellowstone, Milk, and James rivers; also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 5c.

*61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.).

70. Geology and water resources of the Patrick and Goshen Hole quadrangles, in eastern Wyoming and western Nebraska, by G. I. Adams. 1902. 50 pp., 11 pls. 15c.

Describes the geologic formation, surface features, water supply (surface and underground), irrigation, and agricultural products of a part of the Great Plains; discusses settlement and occupancy of public lands, and in an appendix gives the text of the "desert-lands" act, the Carey act, and an act for the construction of reservoirs on public lands for the watering of stock.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River irrigation divisions, drainage, and irrigation, and gives records of stream flow.

90. Geology and water resources of part of the lower James River Valley, South Dakota, by J. E. Todd and C. M. Hall. 1904. 47 pp., 23 pls. 35c.

Describes topography, geologic formations, and surface and underground waters of Davison, Hanson, Sanborn, Beadle, and Miner counties, and portions of Kingsbury, Jerauld, Aurora, and McCook counties, S. Dak.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Irrigation in North Dakota by pumping, by F. A. Wilder. Discusses the use of lignite as a fuel for the operation of farm engines.

South Dakota investigations, by Raymond F. Walter. Mentions surveys of reservoir sites on creeks north of Rapid City and the water supply of the Belle Fourche project.

Work on North Platte River in Wyoming, by John E. Field.

Investigations in Wyoming, by Jeremiah Ahern. Describes the Lake De Smet and the Shoshone projects.

Reclamation and water storage in Nebraska, by O. V. P. Stout. Describes North Platte River and discusses its possible use for irrigation. Gives tables showing monthly discharge of the river from 1895 to 1902 and the volume of storage necessary to insure water to meet possible demands. Describes also Frenchman, Loup, and Niobrara rivers.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives notes on early floods in Mississippi Valley, and describes floods on Kansas River and its tributaries (Blue, Republican, Solomon, Saline, and Smoky Hill rivers); gives an account of the losses and suggests methods of flood prevention; contains also discharge tables and compares flood and ordinary data.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on wells and springs of Minnesota and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. Superseded by 152.

Cites statutory restriction of water pollution.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains a brief report on the "Spring system of the Decaturville dome, Camden County, Mo.," by E. M. Shepard. Some of these springs are of immense size and present many points of interest.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:

Missouri, by E. M. Shepard.

Iowa, by W. H. Norton.

Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

117. The lignite of North Dakota and its relation to irrigation, by F. A. Wilder. 1905. 59 pp., 8 pls. 10c.

Describes the thickness, extent, variations, and fuel value of the lignite and its use for pumping water, the area, soils, and lignite of the river flats, and the status of irrigation in the State.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts relating to ground waters in Colorado, Nebraska, South Dakota, and Wyoming.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.]

Contains brief account of the organization of the hydrographic (water-resources) branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service.

A brief report on "Irrigation development in North Dakota," by H. A. Storrs. Discusses the feasibility of pumping water from the Missouri to irrigate bench lands along its banks.

147. Destructive floods in United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Belle Fourche River flood, South Dakota, from report of R. F. Walter. Describes floods on Belle Fourche River (tributary to the Missouri through Cheyenne River) and on Cache la Poudre River and Crow Creek (tributaries of the South Platte).

*149. Preliminary list of deep borings in United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives, by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Colorado, Iowa, Kansas, Minnesota, Missouri Nebraska, North and South Dakota and Wyoming.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods in eastern Missouri and South Dakota, and estimates of flood discharge and frequency on Kansas, Loup, and Platte rivers; contains also index to literature on floods in American streams.

*184. The underflow of the South Platte Valley, by C. S. Slichter and H. C. Wolff. 1906. 42 pp. 5c.

Describes investigations of velocity, direction, quantity of underflow, and the underflow ditch at Ogalalla, Nebr., gives chemical analyses of the water, and discusses disadvantages of under flow canals; describes also the investigation at North Platte, Nebr., and gives suggestions for construction of small pumping plants.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of waters, and many well records.

*215. Geology and water resources of a portion of the Missouri River valley in northeastern Nebraska, by G. E. Condra. 1908. 59 pp., 11 pls. 40c.

Describes topography, rock formations, mineral resources, streams, springs, shallow and artesian wells, soils, crops, and timber, in Boyd, Knox, Cedar, Dixon, and Dakota counties, and part of Holt County.

*216. Geology and water resources of the Republican River valley and adjacent areas, Nebraska, by G. E. Condra. 1907. 71 pp., 13 pls. 15c.

Describes topography, drainage, temperature, rainfall, winds, rock systems, surface and underground waters, water powers, soils, crops, and timbers of Dundy, Hitchcock, Redwillow, Furnas, Harlan, Franklin, Webster, Nuckolls, Thayer, and Jefferson counties.

221. Geology and water resources of the Great Falls region. Montana, by C. A. Fisher. 1909. 89 pp., 7 pls. 20c.

Describes the topographic features, geologic formation, streams, lakes, swamps, springs, and artesian wells of a portion of the Great Plains in Cascade, Teton, Fergus, Chouteau, and Lewis and Clark counties; discusses the chemical character of the waters (analyses), water powers, irrigation, temperature, rainfall, and agriculture, and gives details of water supplies by districts.

*227. Geology and underground waters of South Dakota, by N. H. Darton. 1909 156 pp., 15 pls. 40c.

Describes physical features, geologic formations, water horizons, and, by counties, deep wells and well prospects; gives notes on construction and management of artesian wells.

*230. Surface water supply of Nebraska, by J. C, Stevens. 1909. 251 pp., 6 pls. 35c.

Discusses relation of rainfall to run-off and evaporation and seepage near Kearney; describes the river basins, and gives results of observations at gaging stations.

236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examinations, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Missouri North Platte, and Platte rivers.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains brief report entitled "The utilization of the underflow near St. Francis, Kans.," by H. C. Wolff; discusses the water-bearing material, velocity, amount, rate of movement and quality of the waters; arrangement and method of sinking the wells, selection and installation of pumps, engines and cost of pumping, storage reservoirs, and loss by evaporation.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from streams in Missouri River basin.

293. Underground water resources of Iowa, by W. H. Norton, W. S. Hendrixson, H. E. Simpson, O. E. Meinzer, and others. 1912. 994 pp., 18 pls. 70c.

Describes the relief, drainage, temperature, and precipitation of the State and the geologic formations; discusses the geologic occurrence of underground waters, artesian phenomena and yield of artesian wells, the chemical composition of underground waters, municipal, domestic, and industrial water supplies, and mineral waters; gives details concerning topography, geology, underground waters, and city and village supplies by districts and counties.

*345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(*g*) The water resources of Butte, Mont., by O. E. Meinzer (pp. 79-125, pls. 7-8.)

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp.

Contains analyses from spring and well waters from Missouri, Wyoming, Yellowstone National Park, Montana, and Colorado, and of mine waters from Butte, Mont.

367. Profile surveys of Missouri River from Great Falls to Three Forks, Montana, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 1 pl. (13 sheets). 50c.

Gives a brief description of the general features of the Missouri River basin, a list of the gaging stations that have been maintained between Three Forks and Great Falls, and of the publications containing the results of stream-flow measurements.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

(*b*) Ground water for irrigation in Lodgepole Valley, Wyo.-Nebr., by O. E. Meinzer (pp. 37-69, pls. 4-6). Describes the physiography and geology of Lodgepole Valley and the adjacent region and the water in the alluvial gravel and in the Tertiary and Cretaceous formations; discusses irrigation with ground water; gives well data and analyess of 20 well waters and 2 samples from Lodgepole Creek; contains maps showing the geology and the depths to the water table; also includes data on the cost of pumping for irrigation in western Nebraska, by H. C. Diesem, U. S. Department of Agriculture.

[illegible]. **Artesian water in the vicinity of the Black Hills, S. Dak., by N. H. Darton. 1918. 64 pp., 13 pls.**

Describes the geology and artesian-water conditions in areas covered in previous reports but in the light of additional data. Discusses the artesian prospects of the Dakota, Minnelusa, and Deadwood sandstones. Contains a map showing the geology and the depths to the water bearing sandstones.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89; J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90; J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp., 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurements, rainfall, and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1980–91; J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp., 93 pls. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ended June 30, 1891, by A. H. Thompson, pp. 1–212, pls. 54–57. Describes reservoir sites in Meagher, Lewis and Clark, Beaverhead, Madison, Chouteau, Cascade, and Fergus counties, Mont., and for each site gives the location, brief description of the drainage basin, height of dam, capacity of reservoir, and the area of segregated land.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92; J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Water supply for irrigation, by F. H. Newell, pp. 1–99, pls. 108–110. Discusses areas irrigated and irrigable, fluctuations in rivers and lakes, cost and value of water supply, and describes the location and area, topography, land classification, extent of irrigation, precipitation, and water measurements on the Missouri and its tributaries.

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351–427, pls. 147–182. Describes the reservoirs, canal lines, areas of lands reclaimable, and estimated revenue from irrigation works on the Sun River system, Montana.

Sixteenth Annual Report of the United States Geological Survey, 1894–95; Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 42 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, pls. 35–39. Describes the general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private, miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Water resources of a portion of the Great Plains, by Robert Hay, pp. 535–588, pls. 40–42. Describes an area comprising between 5,000 and 6,000 square miles and including parts of three counties of Kansas, five counties of Nebraska, and six of Colorado, drained to the Missouri through Platte and Kansas rivers; discusses the lakes, streams, and springs of the area, the underflow of the river bottoms, and the water-bearing strata under the higher lands; treats also of the sources of the water supply, rainfall, rate of percolation, and volume; valley, upland, and deep wells; waterless wells, artesian flow, and blowing wells; and the temperature of the well waters; describes briefly the topography and geology of the region and the utilization of the water supply.

Seventeenth Annual Report of the United States Geological Survey, 1895–96; Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. $2.35. Contains:

Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, pp. 603–694, pls. 69–107. Gives an outline of the geologic relations; describes the water horizons and the extent of the artesian water, and gives details concerning wells and prospects by counties; discusses the origin, amount, pressure, head, and composition of the artesian waters, the use of artesian water for power, and gives details concerning artesian irrigation by counties; contains also remarks on the construction and management of artesian wells.

Eighteenth Annual Report of the United States Geological Survey, 1896–97; Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV. Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*New developments in well boring and irrigation in eastern South Dakota, 1896, by N. H. Darton, pp. 561–615, pls. 38–47. Discusses progress in well sinking and irrigation by artesian waters in 1896 in Aurora, Beadle, Bonhomme, Brule, Buffalo, Charles Mix, Davison, Douglas, Hanson, Hutchinson, Jerauld, Sanborn, Spink, and Yankton counties, South Dakota, and in areas west of the Missouri River; treats also of the temperature and volume of flow of the deeper artesian waters and gives chemical analyses of waters from Missouri River and from artesian wells in the Sanborn basin.

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, pls. 48–102. Describes reservoir sites on Goose Creek, Tarryall Creek, and South Fork of South Platte River in Colorado; gives tables of reservoir capacity and areas.

Nineteenth Annual Report of the United States Geological Survey, 1897–98; Charles D. Walcott, Director. 1898. (Pts. II, III, IV, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, viii, 814 pp., 118 pls. $1.85. Contains:

*Preliminary report on the geology and water resources of Nebraska, west of the one hundred and third meridian, by N. H. Darton, pp. 719–785, pls. 74–118. Describes topography and drainage of the area, the general geology of Nebraska, and the geology of the area covered by the report; the water horizons, and deep-seated waters; discusses springs, streams, irrigation, climate, and timber, and gives list of elevations.

——— *Pt. V, Forest Reserves, pp. xvii–400, 110 pls. (16 maps in separate case, paper, 75c.; cloth, $1.00.) $1.25. Contains:

*Black Hills Forest Reserve, by H. S. Graves, pp. 67–164, pls. 14–36.

*Big Horn Forest Reserve, by F. E. Town, pp. 165–190, pls. 37–42.

Yellowstone Park Forest Reserve, southern part, from notes by T. S. Brandegee, pp. 213–216. These reports contain many descriptions of the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99; Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. * Pt. V, Forest Reserves, xix, 498 pp., 159 pl., 8 maps in separate case. $2.80. Contains:

*Pikes Peak, Plum Creek, and South Platte reserves, by J. G. Jack, pp. 39–115, pls. 8–47. Describes briefly the drainage of the forest reserves.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900; Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols, and separate case for maps with Pt. V. * Pt. IV, Hydrography, 768 pp., 156 pls. $2.35. Contains:

*Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton, pp. 489–599, pls. 58–112. Describes the topography and geology of an area comprising about 5,500 square miles in southwestern corner of South Dakota, and the adjoining portion of Wyoming. Discusses the geologic formations and their contained waters, the deep borings at Edgemont and other places, the surface waters (Cheyenne and Fall River, Beaver, Lame Johnny, French, Battle Spring, Hat, Cascade, Stockade Beaver, and Beaver Creeks), and irrigation, the soils, mineral resources, climate, temperature, and timber.

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, pls. 113–146. Describes the area lying in an irregular belt about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, Nebraska, Kansas, New Mexico, Oklahoma, and Texas; discusses the origin and structure of the High Plains, the precipitation temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, pls. 51–65.

——— * Pt. V, Forest Reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Lewis and Clarke Forest Reserve, Montana, by H. B. Ayres, pp. 27–80, pls. 2–32. Briefly describes the valleys of the streams.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*47. Analyses of waters of the Yellowstone National Park, with an account of the methods of analysis employed, by F. A. Gooch and J. E. Whitfield. 1888. 84 pp.

Describes methods used in analyzing natural waters and contains analyses of 43 geyser, spring, and surface waters in Yellowstone National Park.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Kansas and Missouri, and detailed records of wells in Greeley County, Kansas, and Randolph County, Missouri. These wells were selected because they give definite stratigraphic information.

265. Geology of the Boulder district, Colo., by N. M. Fenneman. 1905. 101 pp., 5 pls. 15c.

Describes the geology of a rectangular area 16 miles north and south by 9 miles east and west, in the southwestern part of which is situated the city of Boulder. Discusses briefly (pp. 67–69) the flowing wells and water-bearing formations, including the Dakota sandstone. Contains a geologic map of the area.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, and detailed records of wells in Geary and Wyandotte counties, Kansas; Jackson County, Missouri; Teton County, Montana; and Beadle and Miner counties, South Dakota. The wells of which detailed sections are given were selected because they afford valuable stratrigaphic information.

364. Geology and mineral resources of the Laramie Basin, Wyo. (a preliminary report), by N. H. Darton and C. E. Siebenthal. 1909. 81 pp., 8 pls. 20c.

Describes the geology and contains a geologic map. Includes a section on ground water (pp. 67–78), in which are given well data and 6 water analyses. A part of the area is covered by Geologic Folio 173, which also contains information on ground water.

395. Radioactivity of the thermal waters of Yellowstone National Park, by Herman Schlundt and R. B. Moore. 1909. 35 pp., 4 pls. 10c.

Describes the apparatus and methods used and presents and discusses the results of the experiments.

*471. Contributions to economic geology, 1910, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1912. 663 pp., 62 pls. $1.05.

Issued also in separate chapters. The following paper contains information on ground water: *(a) The Powder River oil field, Wyo., by C. H. Wegemann (pp. 56–75). Describes the geology and contains a geologic map of a quadrangular area which includes Tps. 40–42 N., R. 81 W., and portions of adjoining townships. Contains brief notes on water supplies, including water-bearing formations (pp. 58, 59).

575. Geology of the Standing Rock and Cheyenne River Indian reservations, North and South Dakota, by W. R. Calvert, A. L. Beekly, V. H. Barnett, and M. A. Pishel. 1914. 49 pp., 8 pls. 15c.

Covers an area lying west of Missouri River, north of Cheyenne River, and south of Cannonball River, and extending westward to 102d meridian. Describes the geology and contains a geologic map of the area. Includes a brief discussion of the water in the Dakota and Fox Hills sandstones and in other formations (pp. 24–25).

*621. Contributions to economic geology, 1915, Part II, Mineral fuels; M. R. Campbell and David White, geologists in charge. 1916. 375 pp., 25 pls. 60c.

Issued also in separate chapters. The following chapter contains information on ground water:

*(*l*) Oil and gas near Basin, Big Horn County, Wyo., by C. T. Lupton (pp. 157–190, Pl. XVII), describes the geology and contains a geologic map of parts of Tps. 50–52 N., Rs. 92 and 93 W. Includes a brief description of the water supplies and of the water-bearing sand with a table giving percentages of oil and gas wells that obtained water in each of these sand strata (pp. 164–166). It also includes well records that contain some data in regard to water (pp. 186–189).

627. The lignite field of northwestern South Dakota, by D. E. Winchester, C. J. Hares, E. R. Lloyd, and E. M. Parks. 1916. 169 pp., 11 pls. 25c.

Describes the geology and contains geologic maps of Harding and Perkins counties. Describes the drainage and water supply and contains a small amount of data on deep well not given in Water-Supply Paper 227.

641. Contributions to economic geology, 1916, Part II, Mineral fuels; David White, G. H. Ashley, and M. R. Campbell, geologists in charge.

Issued also in separate chapters. The following chapter contains information on ground water:

(*i*) Anticlines in central Wyoming, by C. J. Hares (pp. 233–280, Pl. XXIII). Covers nearly 5,000 square miles in Natrona and Fremont counties, west of Casper and southeast of Lander. Contains, on pages 235 and 236, a brief discussion of the water supply, including statements regarding various hot springs, springs of large size, sulphur springs, and other mineral springs; also a statement regarding water-bearing formations and artesian prospects. Includes a geologic map.

647. The Bull Mountain coal fields, Musselshell and Yellowstone counties, Mont., by L. H. Woolsey, R. W. Richards, and C. T. Lupton. 1917. 218 pp., 36 pls.

Gives detailed data regarding water supplies, including ground water, for the following townships: Tps. 5–8 N., R. 24 E.; Tps. 5–8 N., R. 25 E.; Tps. 5–8 N., R. 26 E.; Tps. 5–9 N., R. 27 E.; Tps. 5–9 N., R. 28 E.; Tps. 5–9 N., R. 29 E.; Tps. 5–9 N., R. 30 E.; Tps. 5–9 N., R. 31 E.; T. 8 N., R. 32 E.

656. Anticlines in the southern part of the Big Horn Basin, Wyo., a preliminary report on the occurrence of oil, by D. F. Hewett and C. T. Lupton. 1917. 192 pp., 32 pls.

Covers a large region in northwestern Wyoming, west of the Big Horn Mountains. Give detailed data regarding surface waters, springs, wells, and ground-water prospects in the numerous anticlinal areas described in the report. See pages 15, 16, 56–188. Includes a geologic map and section.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*17. Preliminary report on the geology and water resources of Nebraska west of the one hundred and third meridian, by N. H. Darton. 1903. 69 pp., 43 pls. 50c.

Describes topography and general geology of Nebraska, the streams, springs, and deep-seated waters, and irrigation; gives list of elevations.

*32. Preliminary report on the geology and underground water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes topography, drainage, stratigraphy, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota (see Water-Supply Paper 227), Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*53. Geology and water resources of the Bighorn basin, Wyoming, by C. A. Fisher. 1906. 72 pp., 16 pls.

Describes the topography of the region, the stratigraphic, structural, and historical geology, and the underground waters, coal, oil, and gas, building stone, and other mineral resources discusses briefly irrigation and mineral waters.

*65. Geology and water resources of the northern portion of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton. 1909. 105 pp., 24 pls. 40c.

Describes the topography of the region and the stratigraphic, structural, and historical geology of the sedimentary rocks; discusses their mineral resources, including underground water, coal, gypsum, etc.; contains also information concerning the surface waters.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free, but may be obtained from the Geological Survey or from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C., at the prices indicated. An asterisk (*) indicates that the Survey's stock of the paper is exhausted.

25. The glacial Lake Agassiz, by Warren Upham. 1896. 658 pp., 38 pls. $1.70.

Contains a chapter (pp. 523-582) on "Artesian and common wells of the Red River Valley," which discusses the sources of artesian water, the fresh waters in the drift sheets, the saline and alkaline waters in the Dakota sandstone, and the use of artesian water for irrigation; contains analyses of waters from wells, streams, and lakes in Red River Valley and the adjoining region; and gives notes on wells in Clay, Kittson, Marshall, Norman, Polk, Traverse, and Wilkin counties, in Minnesota; in Cass, Grand Forks, Pembina, Richland, Traill, and Walsh counties, in North Dakota; and in a part of the area covered by Lake Agassiz, in Manitoba. The monograph includes numerous maps relating to the Pleistocene geology of the region and a map (Pl. XXXVII) showing the distribution and depths of artesian wells in glacial drift and bedrock.

27. Geology of the Denver Basin in Colorado, by S. F. Emmons, Whitman Cross, and G. H. Eldridge. 1896. 556 pp., 31 pls. $1.50.

Contains a discussion of the water in the Pleistocene deposits (pp. 272, 273) and a section on artesian wells (pp. 401-465). Discusses the history of artesian-water developments in Colorado, the water-bearing horizons, the artesian structure, the quantity of artesian water, and the yield and decrease in yield of flowing wells. Includes three analyses of well waters and maps showing the geology of the region and the original area of artesian flow.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

*24. Three Forks, Montana.
55. Fort Benton, Montana.
*56. Little Belt Mountains, Montana.
85. Oelrichs, South Dakota-Nebraska. 5c.
87. Camp Clark, Nebraska. 5c.
88. Scotts Bluff, Nebraska. 5c.
96. Olivet, South Dakota. 5c.
97. Parker, South Dakota. 5c.
99. Mitchell, South Dakota. 5c.
100. Alexandria, South Dakota. 5c.
107. Newcastle, Wyoming-South Dakota. 5c.
108. Edgemont, South Dakota-Nebraska. 5c.
113. Huron, South Dakota. 5c.
114. De Smet, South Dakota. 5c.
117. Castleton-Fargo, North Dakota-Minnesota. 5c.

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[1] Index maps showing areas in the Missouri River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

*127. Sundance, Wyoming-South Dakota.
*128. Aladdin, Wyoming-South Dakota-Montana. 5c.
*141. Bald Mountain-Dayton, Wyoming. 5c.
*142. Cloud Peak-Fort McKinney, Wyoming. 5c.
*150. Devils Tower, Wyoming.
156. Elk Point, South Dakota-Nebraska-Iowa. 5c.
165. Aberdeen-Redfield[1] (Northville, Aberdeen, Redfield, and Byron quadrangles), South Dakota. 5c.
168. Jamestown-Tower[1] (Jamestown, Eckleson, and Tower quadrangles), North Dakota. 5c.
181. Bismarck,[1] North Dakota. 5c.
196. Philipsburg, Montana. 25c.
206. Leavenworth, Smithville, Missouri-Kansas. 25c.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the Missouri River basin are the reports of the Chief of Engineers, United States Army, of the State geologist of Kansas, the State Drainage Commission of Minnesota, the Commission on Conservation of the State of Montana, the State Board of Irrigation of Nebraska, the superintendent of the Department of Irrigation, Forestry, Fish, and Game of North Dakota, and the State engineer of Wyoming. The following reports deserve special mention:

The Missouri River and its utmost source, by J. V. Brower. St. Paul, 1896.

Geological report of the exploration of the Yellowstone and Missouri rivers, by F. V. Hayden. Washington, 1869.

Preliminary examination of reservoir sites in Wyoming and Colorado: 55th Cong., 2d session, House Doc. 141.

Report of the Commission appointed by his excellency the governor of the State of Colorado to revise the laws of the State [of Colorado] regulating the appropriation, distribution, and use of water. Denver, 1890.

Some aspects of irrigation development in Colorado, by G. G. Anderson: Colorado Sci. Soc. Proc., vol. 9, 1909.

Special report on well waters in Kansas, by Erasmus Haworth; Kansas Univ. Geol. Survey Bull. 1.

Report of Board of Irrigation Survey and Experiment [Kansas] for 1895–96. Topeka, 1897.

Water supplies of Kansas, by C. A. Haskins and C. C. Young: Univ. of Kansas Bull. 5, vol. 16, 1915.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests. Helena, 1911.

Irrigation laws of the State of Wyoming; compiled in the office of the State engineer.

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[1] Issued in two editions—library and octavo. Specify edition desired.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports which are not readily classifiable by drainage basins and which cover a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill, its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.

*42. The windmill, its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901-2. (See also Nos. 64, 94, and 95.)

*64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow, and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws of measurements of stream flow; gives formulas for rainfall, run-off, and evaporation; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the report of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp, 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

*95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.
The California or "stovepipe" method of well construction, by Charles S. Slichter.
Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.
Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.
Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., and the contamination of rock wells and of streams by waste oil and brine.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential condition of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest.

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Record of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.

*150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists of publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage-disposal problem, by C.-E. E. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification by intermittent sand filtration and in beds of coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination well and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of under ground water, artesian conditions, and oil and gas bearing formations; gives history of well-drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and cost of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

*(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65. Scope indicated by title.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914, as follows:

*(c) Relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77-84.

(e) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117-130

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131-139.

400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chie hydraulic engineer.

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1-8.
*(c) The measurement of silt-laden streams, by Raymond C. Pierce, pp. 39-51.
(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

416. The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continually being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

425. Contributions to the hydrology of the United States, 1917. N. C. Grover, chief hydraulic engineer. 1918. Contains:

(c) Hydraulic conversion tables and convenient equivalents, pp. 71-94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883-84, J. W. Powell Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125-173, pl. 21. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. Part II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363-561, pls. 107-146. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891-92, J. W. Powell, Director. 1892. (Parts II and III, 1893.) 3 parts. *Part III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101-349, pls. 111-146. Discusses the economical aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892-93, J. W. Powell, Director. 1893. (Part II, 1894.) 2 parts. *Part II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*Natural mineral waters of the United States, by A. C. Peale, pp. 49-88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897-98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Part V. *Part II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59-294, pls. 6-16. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295-384, pl. 17. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898-99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Part V. *Part IV, Hydrography, vii, 660 pp., 75 pls. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563-637, pls. 64-75. Describes the topographic features of the boundary, the Lake Basin, and Rio San Jaun; gives a brief résumé of the boundary dispute; discusses rainfall, temperature, and relative humidity, evaporation, resources and productions, the ship-railway and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Jaun and its tribucaries.

Twenty-second Annual Report of the United States Geological Survey, 1900-1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. *Part IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507-630, pls. 37-50. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharge of many of the streams, and rainfall and evaporation tables for various points.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the relation of agriculture, lumbering mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load, and specially to determine how the quantity of load is related to the stream's slope and discharge and to the degree of comminution of the débris."

A highly technical report.

105. Hydraulic mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural water; gives a classification of water based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

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DEPARTMENT OF THE INTERIOR
Franklin K. Lane, Secretary

UNITED STATES GEOLOGICAL SURVEY
George Otis Smith, Director

Water-Supply Paper 437

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART VII. LOWER MISSISSIPPI RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
ROBERT FOLLANSBEE, District Engineer

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

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SURFACE WATER SUPPLY OF THE LOWER MISSISSIPPI RIVER BASIN, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

The data presented in these reports were collected by the United States Geological Survey under authority implied in the organic law (20 Stat. L., p. 394), which contains the following paragraph:

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies of water supply for irrigation. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1917.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000

In the execution of the work many private and State organizations have cooperated, either by furnishing data or by assisting in collecting data. Acknowledgements for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 11.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements were made at other points.

In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, acre-feet, and millions of cubic feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross-section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 7–9).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off depths in inches" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.03719	1.041	1.079	1.116	1.153
2.........	.07438	2.083	2.157	2.231	2.306
3.........	.11157	3.124	3.236	3.347	3.459
4.........	.14876	4.165	4.314	4.463	4.612
5.........	.18595	5.207	5.393	5.578	5.764
6.........	.22314	6.248	6.471	6.694	6.917
7.........	.26033	7.289	7.550	7.810	8.070
8.........	.29752	8.331	8.628	8.926	9.223
9.........	.33471	9.372	9.707	10.041	10.376

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	1.983	55.54	57.52	59.50	61.49
2.........	3.967	111.1	115.0	119.0	123.0
3.........	5.950	166.6	172.6	178.5	184.5
4.........	7.934	222.1	230.1	238.0	246.0
5.........	9.917	277.7	287.6	297.5	307.4
6.........	11.90	333.2	345.1	357.0	368.9
7.........	13.88	388.8	402.6	416.5	430.4
8.........	15.87	444.3	460.2	476.0	491.9
9.........	17.85	499.8	517.7	535.5	553.4

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.0864	2.419	2.506	2.592	2.678
2.........	.1728	4.838	5.012	5.184	5.356
3.........	.2592	7.257	7.518	7.776	8.034
4.........	.3456	9.676	10.02	10.37	10.71
5.........	.4320	12.10	12.53	12.96	13.39
6.........	.5184	14.51	15.04	15.55	16.07
7.........	.6048	16.93	17.54	18.14	18.75
8.........	.6912	19.35	20.05	20.74	21.42
9.........	.7776	21.77	22.55	23.33	24.10

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the values 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre- inch per hour.

1 second-foot for one year (365 days) equals 724 acre-feet.

1 second-foot for one day equals 86,400 cubic feet.

1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.

1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.

1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.

1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.

1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.

100 California miner's inches equals 18.7 United States gallons per second.

100 California miner's inches for one day equals 4.96 acre-feet.

100 Colorado miner's inches equals 2.60 second-feet.

100 Colorado miner's inches equals 19.5 United States gallons per second.

100 Colorado miner's inches for one day equals 5.17 acre-feet.

100 United States gallons per minute equals 0.223 second-foot.

100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quckly: $\frac{\text{Second-feet}\times\text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the 1st of January, in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring bread-up; at the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter by the general methods outlined in standard textbooks on the measurement of river discharge. (See Pls. I and II.)

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the daily discharge from which the monthly and yearly mean discharge is determined.

The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of channel, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

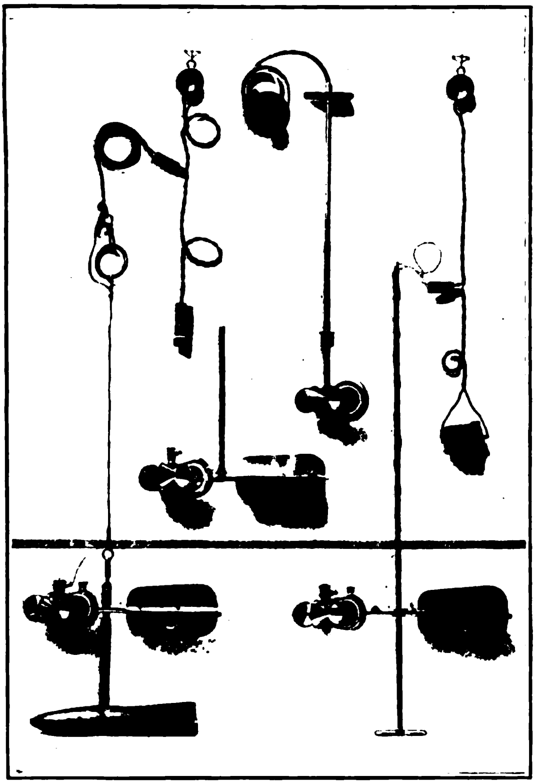
The table of daily discharge gives the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by weighting discharge for parts of the day.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 6, are based.

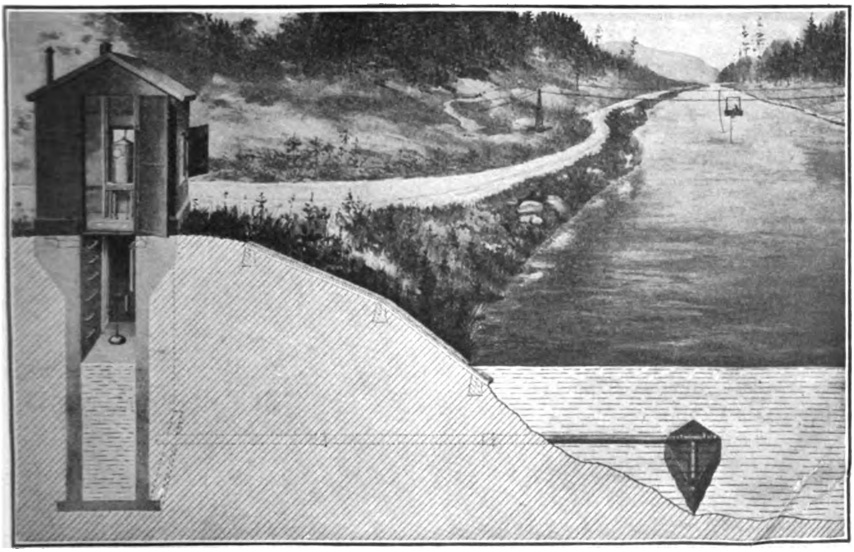
ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanency of the stage-discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

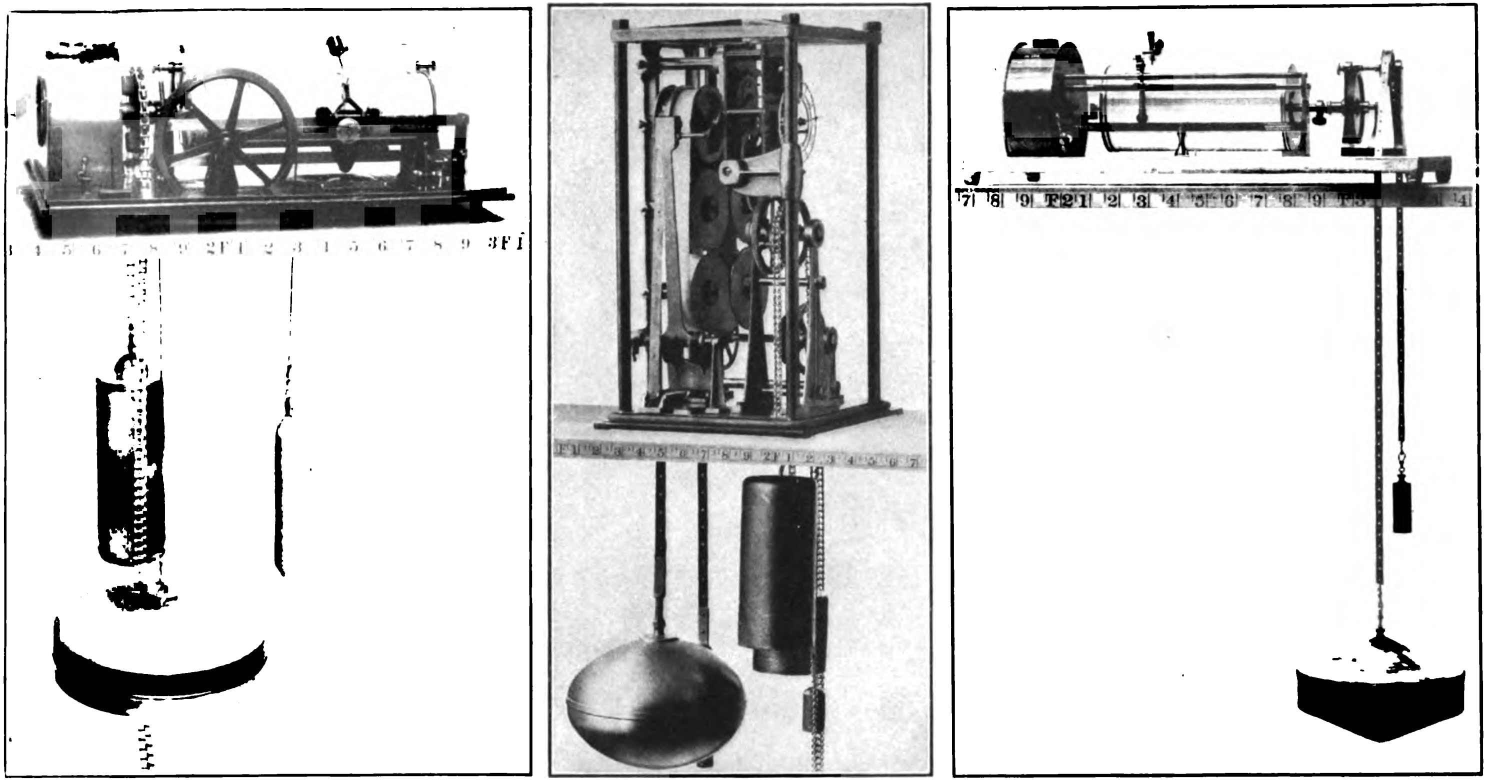
A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



A. STEVENS.

B. GURLEY PRINTING.

C. FRIEZ

WATER-STAGE RECORDERS.

gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

For the rating curves "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the survey should be used with caution because of possible inherent sources of error not known to the survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

In Colorado the State engineer paid the observers on Arkansas River at Granite and Salida. The United States Forest Service furnished readings on South Fork of Arkansas River and Poncha Creek at Poncha, and winter readings on East Fork of Arkansas River and Tennessee Fork near Leadville.

The Arkansas Valley Railway, Light & Power Co. furnished complete records for West Beaver Creek near Victor.

Mr. B. B. McReynolds, superintendent of the water department, Colorado Springs, furnished records of flow of streams in the Pikes Peak region.

The United States Reclamation Service paid for the maintenance of the stations on Medicine Bluff Creek near Lawton, Okla., and Little Medicine Bluff Creek near Lawton, Okla., and at the Evaporation station in Lawton Reservoir, Okla.

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[1] For a more detailed discussion of the accuracy of stream-flow data, see Grover, N. C., and Hoyt, J. C., Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53–59, 1916.

DIVISION OF WORK.

The data were collected and prepared for publication under the direction of Robert Follansbee, by W. R. King, T. J. Watkins, H. W. Fear, P. V. Hodges, H. K. Smith, and J. H. Baily.

The manuscript was reviewed by H. J. Dean.

GAGING-STATION RECORDS.

ARKANSAS RIVER BASIN.

EAST FORK OF ARKANSAS RIVER NEAR LEADVILLE, COLO.

Location.—In sec. 16, T. 9 S., R. 80 W., at highway bridge about 200 yards above mouth of Tennessee Fork, 3 miles northwest of Leadville, in Lake County.

Drainage area.—52 square miles (measured on topographic map).

Records available.—April 25 to August 31, 1890; June 18 to September 29, 1903; June 5, 1911, to September 30, 1916.

Gage.—Vertical staff on left bridge abutment, near upstream end; read by Fred Coquoz. No known relation between present gage and gages used prior to 1911.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Channel composed of coarse gravel and small boulders. Control 30 feet downstream from gage; practically permanent. Banks low and subject to overflow at extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 1.3 feet June 12 (discharge, 328 second-feet); minimum discharge recorded, 7 second-feet April 3 and 14; actual minimum may have occurred during winter months when observations are discontinued.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter months.

Diversions.—The Leadville Water Co. makes a continuous diversion of 2 second-feet from the East Fork above the station. During the winter months this diversion may be increased to 3 second-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 10 and 250 second-feet. Gage read to quarter-tenths twice daily. Owing to high altitude of drainage area (9,700 feet), alternate melting and freezing at certain seasons probably causes considerable diurnal fluctuation, and mean daily gage heights based on morning and evening readings may be somewhat in error. Daily discharge ascertained by applying mean daily gage heights to rating table. Results good.

The following discharge measurement was made by W. R. King:

June 10, 1916: Gage height, 1.01 feet; discharge, 193 second-feet.

Daily discharge, in second-feet, of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	20	....	35	191	82	75	82
2	25	22	....	35	212	82	99	82
3	25	28	7	23	251	55	91	79
4	25	27	....	23	274	43	72	75
5	28	23	....	25	225	62	84	59
6	27	28	....	32	153	49	91	53
7	23	32	....	82	191	34	104	55
8	22	34	....	172	216	35	88	49
9	21	....	....	183	256	59	99	38
10	20	....	....	199	274	82	91	48
11	18	....	....	172	279	99	75	49
12	17	....	....	161	328	110	62	43
13	17	....	....	161	270	99	66	48
14	18	....	7	161	274	117	99	48
15	16	....	....	161	242	110	93	32
16	15	....	....	146	251	99	75	38
17	18	....	....	146	225	84	60	41
18	22	....	....	161	172	99	66	68
19	25	....	....	161	199	88	66	62
20	28	....	....	114	191	93	55	59
21	32	....	....	88	191	75	70	45
22	32	....	10	66	146	75	91	37
23	28	....	....	62	140	53	88	48
24	28	....	....	66	127	70	91	48
25	25	....	22	82	127	55	96	49
26	20	....	....	75	107	75	82	41
27	22	....	35	99	99	59	79	38
28	18	....	....	114	75	75	75	30
29	14	....	....	127	70	99	82	25
30	16	....	....	140	70	99	66	23
31	18	....	....	168	....	93	75	....

Monthly discharge of East Fork of Arkansas River near Leadville, Colo., for the year ending Sept. 30. 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	32	14	22.1	1,360
November 1-8	34	20	26.8	425
May	199	23	111	6,820
June	328	70	194	11,500
July	117	34	77.7	4,780
August	104	55	80.8	4,970
September	82	23	49.7	2,960

ARKANSAS RIVER AT GRANITE, COLO.

Location.—In sec. 31, T. 11 S., R. 79 W., at Granite, in Lake County, below mouth mouth of Lake Creek, and above Lost Canyon and Clear creeks.

Drainage area.—425 square miles.

Records available.—May 1, 1897, to September 10, 1899; April 6, 1910, to September 30, 1916.

Gage.—Bristol water-stage recorder and inclined staff gage established in 1910 by State engineer on left bank half a mile above Denver & Rio Grande Railroad station at Granite. No known relation between present gage and that used from 1897 to 1899.

Discharge measurements.—Made from highway bridge near railroad station or by wading.

Channel and control.—Bed composed of coarse gravel and small boulders. Control shifts at intervals, but practically permanent after winter of 1915–16. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, from inclined gage, 3.8 feet for several days in June (discharge, 1,660 second-feet); minimum discharge occurs during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter months.

Diversions.—Court decrees for diversions of 74 second-feet from the Arkansas between this station and the junction of Tennessee and East forks.

Regulation.—Discharge affected by operation of Twin Lakes reservoir, which has a storage decree for 20,645 acre-feet.

Accuracy.—Stage-discharge relation practically permanent after winter of 1915-16; affected by ice during winter. Rating curve used during October and November fairly well defined throughout, and after March 16, well-defined between 60 and 1,600 second-feet. From March 10 to April 27 water-stage recorder was operating satisfactorily and mean daily gage heights were determined by inspection of gage-height graph. For remainder of year staff gage was read to tenths once daily. Daily discharge was ascertained by applying directly to rating table mean daily gage heights during operation of water-stage recorder, or one reading per day from staff gage. Results fair.

Discharge measurements of Arkansas River at Granite, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec.-ft.*
Nov. 24	W. R. King..........	1.46	86	June 23	W. R. King..........	3.40	1,260
May 11	H. E. Turner.........	3.10	858	July 23	.....do.................	2.64	639
June 5	Robert Follansbee....	3.60	1,460				

Daily discharge, in second-feet, of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	115	85	....	148	490	910	1,460	1,560	280
2	104	76	....	148	490	910	1,460	1,560	240
3	94	85	....	148	490	910	1,460	1,560	240
4	85	76	....	148	490	1,360	1,460	1,170	240
5	94	85	....	148	402	1,460	1,460	1,170	240
6	94	85	....	130	430	1,460	1,460	1,170	240
7	85	94	....	130	430	1,460	1,410	1,170	165
8	85	85	....	130	615	1,460	1,360	1.170	165
9	85	85	....	115	755	1,460	1,560	1,170	165
10	85	85	200	130	830	1,560	1,560	1,170	200
11	85	76	430	182	990	1,660	1,560	1,170	240
12	85	85	490	220	1,080	1,660	1,460	1,170	200
13	94	85	490	220	1,260	1,560	1,360	1,170	200
14	94	85	430	220	1,360	1.660	1,360	1,170	200
15	104	85	460	220	1,360	1,660	1,360	1,170	165
16	127	85	460	200	910	1,660	1,360	1,170	165
17	115	85	490	220	910	1,660	1,360	685	165
18	104	85	490	302	910	1,560	1,360	685	165
19	94	85	520	100	685	1,560	1,360	685	165
20	94	85	490	182	685	1,560	1,260	685	165
21	94	85	490	240	755	1,560	830	685	165
22	115	85	460	260	755	1,560	830	430	165
23	115	85	490	325	755	1,460	615	430	130
24	104	86	490	350	755	1,460	615	430	165
25	94	86	490	375	755	1,360	550	430	130
26	94	86	260	402	755	1,360	550	430	165
27	94	86	115	490	615	1.360	550	430	200
28	85	86	148	430	615	1,260	550	430	200
29	94	86	165	430	650	1,360	615	825	200
30	104	86	148	430	685	1,460	685	. 325	130
31	94	....	148	....	910	....	1,260	325	....

NOTE.—Stage-discharge relation affected by ice Nov. 13-20; discharge estimated; observations discontinued for remainder of winter. Discharge estimated Nov. 21-23, 25-30, and interpolated May 29, June 29, July 7, 29, and Aug. 25. Indirect methods for shifting control used October and November.

Monthly discharge of Arkansas River at Granite, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	127	85	97.1	5,970
November	94	76	84.6	5,030
March 10-31	520	115	380	16,600
April	490	100	239	14,200
May	1,360	402	761	46,800
June	1,660	910	1,440	85,700
July	1,560	550	1,160	71,300
August	1,560	325	881	54,200
September	280	130	188	11,200

ARKANSAS RIVER AT SALIDA, COLO.

LOCATION.—In sec. 32, T. 50 N., R. 9 E., at Salida, in Chaffee County, some distance above mouth of South Fork of Arkansas River, the nearest important tributary.

DRAINAGE AREA.—1,160 square miles.

RECORDS AVAILABLE.—April 11, 1895, to October 31, 1903; November 3, 1909, to September 30, 1916.

GAGE.—Bristol water-stage recorder on right bank 400 feet below highway bridge in city park; installed by State engineer.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

Channel and control.—Bed composed of coarse gravel; shifts at intervals; no well-defined control. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 4.75 feet at 10 a. m. June 14 (discharge, 3,080 second-feet); minimum stage, 0.40 foot February 1 (discharge, 192 second-feet).

Ice.—Stage-discharge relation not affected by ice, as river is kept open by springs.

Diversions.—Court decrees for diversions of 202 second-feet from the Arkansas between this station and Granite.

Regulation.—Flow at station regulated to some extent by Twin Lakes and Clear Creek reservoirs, which have storage decrees for 20,645 and 11,489 acre-feet, respectively.

Accuracy.—Stage-discharge relation not permanent but shifts through narrow limits; not affected by ice. Rating curves fairly well defined between 200 and 3,000 second-feet. Daily discharge ascertained by applying to rating tables mean daily gage heights determined by inspection of gage-height graph. Results good.

Discharge measurements of Arkansas River at Salida, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 19	T. J. Watkins	0.80	284	June 21	W. R. King	4.48	2,810
Feb. 17	do	.59	242	30	H. E. Turner	4.25	2,210
Apr. 18	Thos. Grieve, jr	1.12	403	July 24	W. R. King	2.49	1,080
June 6	Robert Follansbee	3.75	2,220				

Daily discharge, in second-feet, of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	368	300	270	282	192	238	264	679	1,510	2,590	2,500	520
2	350	300	270	240	203	226	264	708	1,550	2,540	2,320	545
3	332	300	285	264	226	203	264	651	1,510	2,540	2,110	496
4	315	300	270	294	251	214	264	651	1,830	2,410	2,110	496
5	315	300	270	291	251	278	264	708	2,070	2,360	2,030	496
6	315	300	270	291	238	251	251	767	2,190	2,150	1,950	496
7	285	315	242	245	251	214	251	925	2,190	2,110	1,910	496
8	332	285	242	245	251	226	264	1,100	2,110	2,110	1,790	473
9	350	300	255	288	238	264	251	1,350	2,190	2,280	1,710	452
10	385	300	270	285	238	292	251	1,510	2,320	2,590	1,590	473
11	350	255	255	270	251	292	264	1,630	2,540	2,500	1,130	596
12	350	242	255	218	238	596	292	1,910	2,720	2,460	1,100	623
13	368	270	270	228	203	651	292	1,990	2,860	2,360	1,310	596
14	350	242	285	240	203	623	307	1,950	2,900	2,190	1,550	570
15	332	270	300	267	214	545	322	1,830	2,770	2,030	1,630	570
16	350	285	270	264	214	570	307	1,590	2,820	1,750	1,630	570
17	385	270	285	238	226	570	322	1,130	2,860	1,750	1,350	545
18	385	255	255	264	238	596	338	990	2,860	1,750	1,200	496
19	402	270	242	278	238	651	373	925	2,900	1,590	1,130	496
20	368	285	230	264	288	651	355	860	2,860	1,430	1,060	473
21	350	300	242	251	238	679	452	892	2,770	1,350	958	452
22	332	285	270	226	238	623	545	892	2,590	1,310	892	410
23	350	270	285	264	238	679	520	860	2,360	1,130	737	430
24	332	300	242	264	226	623	570	737	2,190	1,060	828	430
25	350	285	242	264	214	520	623	651	2,070	990	797	430
26	332	285	255	251	214	520	651	679	2,070	958	767	430
27	315	285	218	238	238	307	708	737	2,150	958	737	452
28	300	230	242	251	238	307	828	797	2,230	990	708	430
29	300	255	285	226	238	307	860	892	2,320	990	651	430
30	315	300	285	226	....	278	767	958	2,460	1,550	596	430
31	315	....	300	214	....	278	....	1,240	....	2,190	570	....

Note.—Indirect methods for shifting control used Jan. 1-18 and June 22 to Sept. 30.

Monthly discharge of Arkansas River at Salida, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	402	285	341	21,000
November	315	230	281	16,700
December	300	218	263	16,200
January	294	214	256	15,700
February	251	192	230	13,200
March	679	208	428	26,300
April	860	251	409	24,300
May	1,990	651	1,070	65,800
June	2,900	1,510	2,360	140,000
July	2,590	958	1,840	113,000
August	2,500	570	1,330	81,800
September	623	410	493	29,300
The year	2,900	192	777	563,000

TENNESSEE FORK NEAR LEADVILLE, COLO.

Location.—In sec. 16, T. 9 S., R. 80 W., at highway bridge a few hundred yards above mouth of stream and about 3 miles northwest of Leadville, in Lake County.

Drainage area.—45 square miles (measured on topographic map).

Records available.—May 10 to October 31, 1890; June 18 to October 16, 1903; February 8, 1911, to September 30, 1916.

Gage.—Vertical staff on downstream side of left bridge abutment; datum lowered 0.40 foot October 6, 1914. Read by Fred Coquoz. No known relation between present gage and gages used in 1890 and 1903.

Discharge measurements.—Made from bridge or by wading near bridge.

Channel and control.—Bed rough and composed of small boulders; control a short distance below gage at rapids which are practically permanent. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 1.35 feet at 7.30 p. m. June 2 (discharge, 209 second-feet); minimum stage, 0.20 foot October 12 (discharge, 4 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; data insufficient for determination of winter flow.

Diversions.—Court decrees for diversions of 24 second-feet above the station; also a decree for diversion of 18.5 second-feet from the basin of Eagle River to that of Tennessee Fork above station. No water was diverted from Eagle River basin during 1916, so far as known.

Accuracy.—Stage-discharge relation practically permanent; affected by ice. Rating curve fairly well defined between 10 and 200 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Results good.

Discharge measurements of Tennessee Fork near Leadville, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 13	T. J. Watkins	[a]0.62	6.4
Feb. 11	do	[a].48	9.1
June 10	W. R. King	1.26	183

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	7	....	....	166	194	52	65	22
2	10	7	....	....	88	200	52	80	25
3	11	10	....	32	93	166	71	80	26
4	10	10	....	....	90	160	71	71	31
5	10	10	....	....	117	144	88	63	30
6	10	11	....	....	125	149	80	65	27
7	9	11	....	....	160	117	93	63	22
8	8	12	....	....	155	133	90	58	17
9	7	16	....	....	144	144	84	46	18
10	6	14	....	....	149	180	71	42	18
11	5	....	....	....	180	172	65	27	21
12	4	....	....	....	172	172	71	35	17
13	8	....	....	....	152	172	65	43	22
14	10	....	....	32	125	155	52	52	21
15	8	....	....	....	133	152	56	45	17
16	8	....	....	....	133	117	56	32	17
17	8	....	....	....	100	133	42	34	27
18	8	....	....	....	102	133	46	21	42
19	7	....	30	....	102	125	35	30	42
20	8	....	30	....	58	107	34	25	38
21	10	....	....	....	58	71	34	25	46
22	10	....	....	48	50	52	18	18	38
23	11	....	....	....	52	35	16	18	30
24	11	....	....	....	71	35	19	27	25
25	10	....	....	194	88	30	35	22	18
26	10	....	....	....	110	22	19	19	15
27	9	....	32	224	141	17	30	20	14
28	9	....	....	....	155	22	35	22	12
29	9	....	....	....	158	32	38	19	8
30	8	....	....	....	172	35	93	18	8
31	8	....	....	....	188	....	71	18	....

Monthly discharge of Tennessee Fork near Leadville, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	11	4	8.71	536
November 1-10	16	7	10.8	214
May	188	50	122	7,500
June	200	17	113	6,720
July	93	16	54.3	3,340
August	80	18	38.8	2,390
September	46	8	23.8	1,420

COTTONWOOD CREEK BELOW HOT SPRINGS, NEAR BUENA VISTA, COLO.

Location.—In sec. 22, T. 14 S., R. 79 W., half a mile below the old Hot Springs Hotel, and 6 miles west of Buena Vista, in Chaffee County. Nearest tributary, South Fork, enters 2 miles above.

Drainage area.—72 square miles (measured on Forest atlas).

Records available.—April 7, 1911, to September 30, 1916. From September 23, 1910, to September 13, 1911, a station was maintained in sec. 21, a mile above present site.

Gage.—Vertical staff. On February 19, 1915, gage was moved from side of left abutment to downstream end and reset to same datum. In present position water does not pile up on gage, especially during high water, and therefore for same discharge gage height will be less. Read twice daily by E. D. Masters.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Channel composed of boulders; very rough. Control practically permanent; short distance below gage. Banks high; overflow unlikely.

Extremes of stage.—Maximum stage recorded during year, 2.1 feet at 6 a. m., June 20; minimum stage, 0.53 foot at 6 a. m., April 7.

Ice.—Stage-discharge relation not affected by ice; hot springs keep creek open.

Diversions.—Court decrees for diversions of 148 second-feet from Cottonwood Creek, of which 28 second-feet are above gaging station.

Regulation.—None.

Estimates of discharge are withheld from publication until additional data are obtained.

Discharge measurements of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 17	T. J. Watkins	0.61	22.6
June 23	W. R. King	1.50	238
July 27	do	1.10	92

Daily gage height, in feet, of Cottonwood Creek below Hot Springs, near Buena Vista, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.85	0.71	0.68	0.62	0.59	0.57	0.58	0.82	1.45	......	1.38	0.94
2	.84	.70	.66	.64	.61	.57	.59	.87	1.45	1.52	1.25	.92
3	.82	.70	.66	.64	.60	.57	.60	.75	1.48	1.52	1.22	.92
4	.79	.70	.65	.63	.60	.56	.59	.82	1.55	1.48	1.28	.90
5	.78	.69	.65	.63	.60	.58	.58	.85	1.48	1.42	1.20	.90
6	.78	.69	.66	.62	.60	.56	.59	.95	1.45	1.42	1.18	.90
7	.79	.70	.66	.60	.60	.56	.56	1.05	1.4	1.38	1.18	.90
8	.78	.70	.66	.61	.60	.57	.58	1.18	1.38	1.40	1.15	.90
9	.78	.70	.65	.62	.60	.58	.58	1.25	1.5	1.40	1.15	.88
10	.78	.69	.65	.63	.60	.59	.59	1.35	1.65	1.42	1.12	.86
11	.79	.64	.65	.63	.59	.59	.60	1.35	1.75	1.35	1.10	.98
12	.80	.58	.65	.58	.59	.59	.59	1.30	1.8	1.28	1.10	.92
13	.79	.60	.65	.60	.58	.60	.63	1.20	1.9	1.32	1.10	.92
14	.78	.58	.65	.60	.58	.60	.61	1.18	1.9	1.28	1.20	.92
15	.80	.62	.65	.60	.59	.58	.60	1.08	1.9	1.25	1.15	.90
16	.80	.62	.65	.60	.58	.58	.60	.95	1.9	1.28	1.15	.88
17	.80	.62	......	.60	.58	.58	.66	1.02	2.0	1.25	1.12	.87
18	.79	.65	.65	.62	.58	.59	.68	.95	2.0	1.25	1.10	.86
19	.80	.68	.65	.59	.58	.61	.68	1.00	2.0	1.22	1.08	.86
20	.80	.70	.65	.58	.58	.62	.64	1.02	2.0	1.2	1.05	.85
21	.80	.69	.65	.58	.57	.65	.62	.98	2.0	1.15	1.03	.84
22	.79	.69	.65	.59	.57	.62	.69	.98	1.9	1.12	1.00	.83
23	.79	.69	.65	.60	.58	.64	.75	.92	1.65	1.10	.96	.84
24	.79	.69	.65	.60	.57	.62	.77	.92	1.55	1.08	1.00	.85
25	.78	.68	.65	.60	.57	.58	.80	1.00	1.6	1.05	1.00	.85
26	.76	.68	.65	.60	.56	.58	.84	1.02	1.55	1.08	1.00	.84
27	.76	.69	.62	.60	.58	.60	.88	1.02	1.55	1.1	.99	.82
28	.74	.64	.65	.61	.58	.60	.92	1.05	1.6	1.1	.96	.82
29	.74	.66	.65	.60	.58	.60	.98	1.08	1.6	1.08	.96	.80
30	.74	.68	.65	.62	......	.60	.88	1.18	1.55	1.3	1.00	.80
31	.73	......	.65	.59	......	.62	......	1.28	......	1.25	.96	......

CHALK CREEK (UPPER STATION) NEAR ST. ELMO, COLO.

Location.—In sec. 27, T. 15 S., R. 80 W., a quarter of a mile below the power plant of the Tin Cup Gold Dredging Co., and 1½ miles below St. Elmo, in Chaffee County. Nearest tributary, Coal Creek, enters a quarter of a mile below.

Drainage area.—48 square miles (measured on Forest atlas).

Records available.—November 15, 1913, to September 30, 1916.

Gage.—Friez water-stage recorder on left bank.

Discharge measurements.—Made from footbridge near gage or by wading.

Channel and control.—Channel composed of coarse gravel; control a short distance below gage at small rapids which are practically permament. Banks not subject to overflow.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 2.96 feet at 7 p. m., June 10 (discharge, 393 second-feet); minimum stage, 0.92 foot February 12 (discharge, 7 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice except for occasional short periods.

Diversions.—No court decrees for diversions of water that is not returned to the stream above the station.

Regulation.—Low-water flow regulated to a certain extent by a small reservoir at St. Elmo, formed by the diversion dam for the Tin Cup Gold Dredging Co.'s power house.

Accuracy.—Stage-discharge relation permanent; affected by ice for short periods from November to February. Rating curve well defined between 6 and 200 second-feet. Operation of water-stage recorder satisfactory except from February 20 to March 10 and September 17 to 24. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph. Results excellent, except for very high water periods for which they are good.

Discharge measurements of Chalk Creek (upper station), near St. Elmo, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 18	T. J. Watkins	1.11	10.4
June 23	W. R. King	2.23	184

Daily discharge, in second-feet, of Chalk Creek (upper station), near St. Elmo, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26	13	9	10	7	8	12	58	175	175	99	32
2	23	16	10	10	7	8	13	53	175	168	109	30
3	22	15	10	9	8	7	12	47	182	162	90	30
4	19	17	10	9	8	7	12	53	185	150	79	29
5	17	18	10	9	8	7	12	70	170	143	74	27
6	18	23	10	9	8	8	11	101	178	134	79	30
7	17	20	10	9	8	8	12	131	175	136	84	32
8	18	13	10	8	8	8	12	145	182	143	70	32
9	16	11	9	8	8	8	10	162	219	150	67	46
10	17	11	10	8	8	9	13	165	243	148	67	53
11	15	10	11	8	7	9	16	152	246	131	60	36
12	14	10	11	8	7	9	17	162	255	140	58	45
13	15	10	10	9	7	9	19	165	273	122	86	40
14	16	9	10	10	7	18	18	127	267	116	101	32
15	16	9	10	12	7	18	19	101	252	109	80	32
16	16	9	10	11	7	11	19	86	255	114	79	37
17	14	9	10	12	8	10	19	80	258	105	74	36
18	15	9	10	11	8	10	26	80	261	95	62	34
19	14	10	9	10	8	10	26	87	255	88	58	33
20	16	10	10	9	8	10	25	87	237	84	56	32
21	14	10	13	9	8	12	25	79	222	79	53	30
22	13	10	12	9	8	9	29	75	201	82	47	28
23	15	10	10	8	8	11	42	70	190	77	47	26
24	18	10	10	8	8	11	50	72	190	70	47	24
25	18	10	10	8	8	10	54	82	192	67	46	22
26	14	10	10	8	8	10	62	90	192	65	41	20
27	13	10	10	8	8	10	75	101	195	68	38	19
28	12	9	10	8	8	11	88	118	192	65	36	17
29	13	9	9	7	8	11	88	131	190	82	35	18
30	12	9	9	7	......	12	60	152	185	129	35	16
31	13	......	9	7	......	11	......	172	......	103	36	......

NOTE.—Stage-discharge relation affected by ice Nov. 13 to Dec. 3, Dec. 16–20, Jan. 1, 7, 12–14, Jan. 20 to Feb. 5 and Feb. 13–29; discharge estimated from discharge measurements, observer's notes, and weather records. Discharge estimated Mar. 1–10, and Sept. 17–24, when gage did not operate.

Monthly discharge of Chalk Creek (upper station), near St. Elmo, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (tota in acre-feet)
	Maximum.	Minimum.	Mean.	
October	26	12	16.1	990
November	23	9	11.6	690
December	13	9	10.0	615
January	12	7	8.9	547
February	8	7	7.7	443
March	18	7	10.0	615
April	88	10	29.8	1,770
May	172	47	105	6,460
June	273	170	213	12,700
July	175	65	113	6,950
August	109	35	64.3	3,960
September	53	16	30.6	1,820
The year	273	7	51.7	37,600

CHALK CREEK NEAR ST. ELMO, COLO.

Location.—In sec. 28, T. 15 S., R. 79 W., at highway bridge just below the cascades of Chalk Creek, and 6 miles east of St. Elmo, in Chaffee County. Nearest tributary, a small intermittent stream entering from the north just above the station.

Drainage area.—75 square miles (measured on Forest atlas).

Records available.—March 10, 1911, to March 31, 1916, when station was discontinued. From September 6, to December 28, 1910, a station was maintained in sec. 24, T. 15, S., R. 79 W.

Gage.—Vertical staff on downstream side of pile bent; read by W. P. Abbott.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Channel composed of small boulders; rough. Control, which is somewhat shifting, is just below gage. Overflow of banks not likely.

Extremes of discharge.—Maximum stage recorded during year, 1.15 feet October 2 (discharge, 48 second-feet); minimum stage, 0.75 foot March 22 (discharge, 18 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice except for short periods.

Diversions.—No court decrees for diversions from Chalk Creek between the upper station and this one; decrees for 133 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts through narrow limits; affected by ice for short periods from November to March. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Results fair.

The following discharge measurement was made by T. J. Watkins:

January 18, 1916: Gage height, 0.85 foot; discharge, 24.4 second-feet.

Daily discharge, in second-feet, of Chalk Creek near St. Elmo, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1....	48	28	26	25	22	22	16....	32	28	26	23	24	24
2....	48	25	27	25	22	22	17....	33	28	26	22	22	21
3....	45	25	28	25	22	23	18....	34	27	26	22	20	22
4....	42	25	25	25	22	24	19....	34	26	26	22	42	22
5....	36	28	25	25	22	26	20....	33	26	26	22	34	22
6....	32	30	25	25	22	28	21 ...	32	27	25	22	25	22
7....	32	31	25	25	22	28	22....	32	28	25	22	22	21
8....	36	32	25	22	22	25	23....	32	25	25	22	20	25
9....	36	32	28	24	22	25	24....	31	25	25	22	20	25
10....	35	32	28	25	20	22	25....	30	25	25	22	20	25
11....	34	32	25	22	20	22	26....	30	25	25	22	20	25
12....	34	31	25	23	20	22	27....	30	25	25	22	21	25
13....	34	30	25	25	26	22	28....	26	26	25	22	22	25
14....	32	30	25	25	32	20	29....	25	26	25	22	22	25
15....	36	29	22	24	26	20	30....	26	26	25	22	....	25
							31....	27	....	25	22	....	25

Note.—Discharge estimated Nov. 12–19, 25–29, Dec. 1–2, 17–24, 27–31, Jan. 1, 12, 15–17, 21–22, 29–31, Feb. 1–4, 25–26, 29, and Mar. 1–2, because of ice. Discharge interpolated Oct. 1, 3, 10, 17, 20, 24, Nov. 7, 21, Dec. 5, 12, 26, Jan. 2, 9, 23, Feb. 6, 11, 13, 16–17, 20, 27, Mar. 3–5, 12, 19, and 25–27. Indirect methods for shifting control used during open-water periods.

Monthly discharge of Chalk Creek near St. Elmo, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	48	25	33.8	2,080
November	32	25	27.8	1,650
December	28	22	25.5	1,570
January	25	22	23.2	1,430
February	42	20	23.3	1,340
March	28	20	23.5	1,440
The period				9,510

SOUTH FORK OF ARKANSAS RIVER AT PONCHA, COLO.

Location.—In sec. 10, T. 49 N., R. 9 E., at single-span highway bridge about half a mile from Poncha, in Chaffee County. Nearest tributary, Poncha Ceeek, enters one-fourth mile below.

Drainage area.—140 square miles (measured on Forest atlas).

Records available.—January 14, 1911, to September 30, 1916.

Gage.—Vertical staff on left bridge abutment; read by J. M. Cuenin. Datum lowered 1.00 foot August 19, 1914.

Discharge measurements.—Made from bridge or by wading nearby.

Channel and control.—Channel composed of coarse gravel and small boulders; rough. Control 20 feet below gage at small rapids, may shift slightly. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.2 feet during nights of June 14 and 15, as determined from high water marks on gage (discharge, 385 second-feet); minimum stage, 0.60 foot at 4.30 p. m. April 11 and 22 (discharge, 5 second-feet).

Ice.—Stage-discharge relation only slightly affected by ice as river is kept open by springs.

Diversions.—Court decrees for diversions of 32 second-feet from the South Fork above station, and 29 second-feet below; also for 85 second-feet from the North Fork, which enters above.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts through narrow limits; affected by ice for short periods from November to February. Rating curve well defined below 250 second-feet. Gage read to hundredths twice daily, and during certain periods the maximum stage which occurs during the night is also determined from water marks. Daily discharge is ascertained by applying to rating table mean daily gage height determined from either two or three readings. Results good except for winter period, for which they are fair.

Discharge measurements of South Fork of Arkansas River at Poncha, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec.-ft.*
Nov. 24	W. R. King	1.28	47.2	June 6	Robert Follansbee	1.78	108
Jan. 20	T. J Watkins	1.14	32.8	21	W. R. King	2.20	166
Feb. 17	do	1.15	35.8				

Daily discharge, in second-feet, of South Fork of Arkansas River at Poncha, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	32	17	48	41	38	46	15	76	135	120	102	15
2	24	17	49	41	43	48	29	62	135	106	130	12
3	21	17	50	41	50	48	32	60	143	113	102	7
4	26	13	52	41	50	48	26	59	160	93	72	8
5	26	13	43	41	49	46	23	67	143	96	62	7
6	22	15	60	50	50	48	13	87	135	81	67	12
7	25	25	48	55	46	39	14	128	128	81	67	12
8	24	21	46	55	46	46	11	135	135	83	57	12
9	24	16	46	55	49	43	7	143	151	96	52	13
10	26	13	50	55	50	44	7	186	235	117	52	13
11	22	14	46	50	50	48	6	160	265	110	57	14
12	22	30	52	41	50	38	7	151	255	98	52	16
13	26	48	46	41	46	36	12	143	285	102	72	27
14	26	58	46	45	41	37	8	151	310	109	89	26
15	27	62	43	50	41	39	6	120	310	119	83	24
16	28	55	44	50	46	38	6	100	285	107	78	22
17	31	50	46	45	46	39	6	87	245	106	62	21
18	31	55	48	47	50	33	7	60	265	81	62	20
19	28	58	49	50	46	37	8	51	265	76	47	19
20	26	57	50	50	41	35	7	81	245	76	50	17
21	26	50	52	47	46	36	6	59	196	76	46	16
22	26	50	50	45	46	32	5	53	186	81	46	15
23	26	53	52	41	46	30	8	38	168	76	35	18
24	25	48	46	33	41	20	7	26	151	65	37	19
25	27	50	48	33	37	20	10	33	151	32	39	18
26	26	58	48	33	41	13	18	26	151	26	35	15
27	26	60	46	33	46	14	19	30	160	19	28	13
28	20	43	45	41	46	14	35	29	151	18	25	12
29	20	44	44	38	46	13	46	32	143	14	20	10
30	18	46	43	38	......	13	70	81	120	109	20	11
31	18	......	48	35	......	20	......	113	......	123	20	......

NOTE.—Discharge estimated, because of ice, Nov. 29–30, Dec. 1–3, 15–20, 27, Jan. 8–22, 28, Feb. 4, from hydrograph comparison with Arkansas River at Salida. Discharge interpolated Oct. 14, Dec. 28, 29, and Sept. 7–10, and 14–21. Indirect methods for shifting control used July 30 to Sept. 30.

Monthly discharge of South Fork of Arkansas River at Poncha, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	32	18	25.0	1,540
November	62	13	38.5	2,290
December	60	43	47.9	2,950
January	55	33	43.9	2,700
February	50	37	45.6	2,620
March	48	13	34.2	2,100
April	70	5	15.8	940
May	186	26	84.7	5,210
June	310	120	194	11,500
July	123	14	84.2	5,180
August	130	20	57.0	3,500
September	27	7	15.5	922
The year	310	5	57.1	41,500

PONCHA CREEK AT PONCHA, COLO.

LOCATION.—In sec. 10, T. 49 N., R. 8 E., at single-span highway bridge near Poncha, in Chaffee County, about one-fourth mile above mouth of creek.

DRAINAGE AREA.—89 square miles (measured on Forest atlas).

RECORDS AVAILABLE.—January 14, 1911, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left abutment; read by J. M. Cuenin. Gage originally 20 feet upstream on opposite bank; moved to present site on May 6, 1914, and datum lowered 1.00 foot

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel which shifts slightly; no well-defined control. Banks are overflowed to a small extent during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.9 feet during night of June 4, determined from high water mark on gage (discharge, 247 second-feet); minimum stage, 1.00 foot at 8 a. m. November 12 (discharge, 2 second-feet).

ICE.—Stage-discharge relation only slightly affected by ice as creek is kept open by springs.

DIVERSIONS.—Court decrees for diversions of 7 second-feet above station but none below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice except from January 31 to February 3. Rating curve well-defined below 150 second-feet. Gage read to hundredths twice daily and during certain periods the maximum stage which occurs during the night is also determined from water marks. Daily discharge ascertained by applying to rating table mean daily gage height determined from either two or three readings. Results good.

Discharge measurements of Poncha Creek at Poncha, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 24	W. R. King..........	1.45	12.3	June 6	Robert Follansbee...	2.18	81
Jan. 20	T. J. Watkins.......	1.32	8.8	21	W. R. King.........	2.05	60
Feb. 17	.....do...............	1.35	11.1				

Daily discharge, in second-feet, of Poncha Creek at Poncha, Colo, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	13	9	10	8	8	8	7	37	114	34	34	13
	12	11	9	8	8	8	9	38	116	33	54	13
	11	11	9	8	8	10	15	27	131	31	40	10
	12	11	9	8	8	9	19	35	142	31	30	11
	12	11	10	8	8	12	14	39	120	34	26	11
	12	11	9	8	8	9	14	53	116	30	35	18
	11	13	8	8	8	6	10	78	92	30	32	17
	11	12	8	8	8	10	10	100	83	29	29	16
	11	10	8	8	8	12	11	114	83	29	21	16
	11	9	9	8	8	13	14	131	86	33	21	15
	11	6	7	8	8	12	16	131	86	29	26	14
	12	5	7	8	8	13	17	131	83	25	20	14
	11	6	7	8	8	13	18	120	83	33	26	11
	12	5	8	8	8	11	16	120	90	25	25	11
	12	5	8	8	9	10	16	104	97	25	22	10
	13	6	8	8	8	10	16	85	83	24	21	10
	13	6	8	8	9	12	17	80	80	29	20	9
	13	8	8	8	9	12	22	100	80	22	19	9
	13	7	10	8	9	14	25	76	72	21	17	8
	12	10	9	8	8	16	16	80	74	20	19	8
	12	11	8	8	8	17	18	76	76	20	19	7
	12	11	8	8	8	13	22	72	64	18	16	7
	12	12	8	8	8	12	26	78	59	18	17	11
	11	11	8	8	8	12	25	64	54	18	18	9
	12	8	8	8	8	10	38	68	51	16	18	8
	11	5	8	8	8	12	42	83	51	16	18	8
	10	10	8	8	8	10	42	83	52	16	17	7
	10	5	8	8	8	14	55	83	47	17	17	7
	10	8	8	8	8	14	59	83	42	16	16	7
	9	10	8	8	......	14	60	118	35	31	22	7
	9	......	8	8	......	14	......	131	......	48	14	......

NOTE.—Discharge estimated Jan. 31 to Feb. 3, because of ice; interpolated Oct. 14, Dec. 28, 29, Sept. 7-10, and 14-21.

Monthly discharge of Poncha Creek at Poncha, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	13	9	11.5	707
November	13	5	8.77	522
December	10	7	8.29	510
January	8	8	8.0	492
February	9	8	8.14	468
March	17	6	11.7	719
April	60	7	23.0	1,370
May	131	27	84.5	5,200
June	142	35	81.4	4,840
July	48	16	25.8	1,590
August	54	14	23.5	1,440
September	18	7	10.7	637
The year	142	5	25.5	18,500

WEST BEAVER CREEK NEAR VICTOR, COLO.

Location.—In sec. 30, T. 16 S., R. 68 W., at the Skagway power station of the Arkansas Valley Railway, Light & Power Co., about 7 miles southeast of Victor, in Fremont County.

Drainage area.—70 square miles.

Records available.—January 1, 1905, to September 30, 1916.

Method of determining flow.—Water used through power house is brought by pipe line from reservoir 3½ miles upstream; quantity is measured hourly by weir, and a quantity representing the gain or loss in the reservoir during the period is added or subtracted. To determine the natural flow of the stream the seepage through the dam is measured by weir and added to the total quantity thus obtained. This method takes no account of evaporation from the surface of the reservoir.

Diversions.—Above the power reservoir are three reservoirs from which the town of Victor obtains its municipal supply. In the upper basin are four reservoirs from which water is diverted into Lake Moraine and thence by natural channels to Colorado Springs, where it is used as municipal supply. Filings for these diversions from the basin—52 second-feet by ditch and 5 second-feet by pipe line—have not yet been adjudicated. The town of Altman, for municipal supply, has also filed on five reservoir sites in the upper basin, having a combined capacity of 2,300 acre-feet. Below the power plant there are adjudicated decrees for diversions of 57 second-feet from Beaver Creek, which is formed by East and West Beaver creeks. In addition there is an irrigation reservoir in operation which has a filing for 4,760 acre-feet.

Cooperation.—Records are furnished through courtesy of Arkansas Valley Railway Light & Power Co., and are said to be probably correct within 5 per cent.

Monthly discharge of West Beaver Creek near Victor, Colo., for the year ending Sept. 30, 1916.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	12.0	738	May	24.6	1,510
November	7.45	443	June	13.8	821
December	5.49	338	July	7.63	469
January	4.00	246	August	18.1	1,110
February	6.76	389	September	9.14	544
March	8.22	505			
April	8.31	494	The year	10.5	7,600

BOEHMER CREEK NEAR PIKES PEAK, COLO.

Location.—In the NW. ¼ sec. 32, T. 14 S., R. 68 W., 3½ miles south of Pikes Peak, El Paso County, above Little Beaver and Sackett creeks. Elevation of station, 11,000 feet.

Drainage area.—7.2 square miles (measured on topographic map). Of this area approximately 75 per cent is located above timber line. To the natural drainage has been added that of West Beaver Creek above Strickler tunnel intake.

Records available.—October 1, 1909, to September 30, 1916.

Determination of discharge.—Flow measured by sharp-crested weir, 60 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

Regulation.—Flow regulated by series of three reservoirs having an aggregating capacity of 1,400 acre-feet; reservoirs operated by Colorado Springs water department.

Diversions.—Water diverted above weir for use in Victor is measured and added to flow over Boehmer Creek weir to show total run-off.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Boehmer Creek near Pikes Peak, Colo., for the years ending Sept. 30, 1910–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1909–10.						
October	7.93	4.12	6.54	0.908	1.05	402
November	6.23	2.00	5.17	.718	.80	308
December	5.60	3.84	4.50	.625	.72	277
January	4.40	2.50	3.19	.444	.51	196
February	3.10	2.82	3.02	.419	.44	168
March	5.25	2.85	3.64	.506	.58	224
April	11.7	5.72	4.50	.625	.70	268
May	27.8	5.69	13.6	1.89	2.18	836
June	15.0	6.23	8.28	1.15	1.28	493
July	15.0	4.12	7.13	.990	1.14	438
August	22.3	6.67	10.9	1.51	1.74	670
September	7.99	3.57	6.18	.859	.96	368
The year	27.8	2.00	6.42	.891	12.10	4,650
1910–11.						
October	5.29	2.80	4.04	.561	.65	248
November	3.71	2.56	3.24	.450	.50	193
December	3.00	2.60	2.84	.394	.45	175
January	2.80	.90	1.51	.210	.24	92.8
February	2.00	1.26	1.75	.243	.25	97.2
March	2.00	.98	1.45	.201	.23	89.2
April	6.56	1.65	2.70	.375	.42	161
May	18.6	5.29	11.5	1.60	1.84	707
June	8.28	5.60	7.62	1.06	1.18	453
July	29.8	3.30	14.4	2.00	2.31	885
August	22.4	9.36	18.5	2.57	2.96	1,140
September	16.6	3.81	7.22	1.00	1.12	430
The year	29.8	.90	6.45	.896	12.14	4,670
1911–12.						
October	10.1	.90	7.32	1.02	1.18	450
November	1.35	.14	.53	.074	.08	31.5
December	1.82	1.82	1.82	.252	.29	112
January	3.81	1.82	2.71	.376	.43	167
February	....	....	2.30	.319	.34	132
March	....	....	.60	.0834	.10	36.9
April	2.86	2.59	2.73	.379	.42	162
May	28.0	2.61	8.56	1.19	1.37	526
June	21.0	4.47	16.3	2.26	2.52	970
July	10.8	5.87	6.78	.942	1.09	417
August	9.00	7.37	8.11	1.13	1.30	499
September	6.62	1.58	3.38	.468	.52	201
The year	28.0	....	5.10	.709	9.64	3,700

Monthly discharge of Boehmer Creek near Pikes Peak, Colo., for the years ending Sept. 30, 1910–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1912–13.						
October	6.25	2.07	4.37	0.606	0.70	269
November	16.6	2.76	7.37	1.02	1.14	439
December	8.21	1.58	3.98	.552	.64	245
January	1.58	1.13	1.43	.198	.23	87.9
February	1.58	1.13	1.35	.187	.19	75.0
March	1.80	1.80	1.80	.250	.29	111
April	2.19	2.19	2.19	.304	.34	130
May	6.62	2.27	3.46	.480	.55	213
June	8.62	3.50	5.77	.800	.89	343
July	21.7	5.22	10.2	1.42	1.64	627
August	13.6	5.15	9.42	1.31	1.51	579
September	15.6	6.62	13.0	1.80	2.01	774
The year	21.7	1.13	5.38	.746	10.13	3,890
1913–14.						
October	11.9	3.50	6.49	.902	1.04	399
November	3.20	2.61	2.93	.407	.45	174
December	2.61	2.07	2.40	.333	.38	148
January	2.07	1.58	1.90	.264	.30	117
February	1.58	1.58	1.58	.219	.23	87.8
March	1.58	1.58	1.58	.219	.25	97.2
April	2.07	1.58	1.98	.275	.31	118
May	50.0	2.07	19.3	2.68	3.09	1,190
June	50.0	21.2	37.8	5.24	5.85	2,250
July	54.6	15.0	37.2	5.16	5.95	2,290
August	49.7	13.8	25.7	3.57	4.12	1,580
September	15.3	6.60	9.32	1.29	1.44	555
The year	54.6	1.58	12.4	1.72	23.23	9,010
1914–15.						
October	14.6	3.50	4.92	.683	.79	303
November	3.81	2.61	3.23	.448	.50	192
December	2.61	1.82	2.22	.308	.36	136
January	1.35	1.35	1.35	.187	.22	83.0
February	1.35	1.35	1.35	.187	.19	75.0
March	1.35	1.35	1.35	.187	.22	83.0
April	1.35	1.35	1.35	.187	.21	80.3
May	27.1	2.20	12.9	1.79	2.06	793
June	29.6	17.2	22.4	3.11	3.47	1,330
July	32.6	24.2	27.0	3.75	4.32	1,660
August	34.3	20.6	27.6	3.83	4.42	1,700
September	17.3	11.0	12.9	1.79	2.00	768
The year	34.3	1.35	9.95	1.38	18.76	7,200
1915–16.						
October	8.82	4.14	5.15	.714	.82	317
November	8.45	1.82	4.48	.622	.69	267
December	1.82	1.58	1.79	.248	.29	110
January	1.10	1.10	1.10	.153	.18	67.6
February	1.35	1.10	1.23	.171	.18	70.8
March	3.20	1.10	1.34	.186	.21	82.4
April	4.14	3.20	3.57	.495	.55	212
May	14.6	3.81	5.57	.773	.89	342
June	4.72	2.28	3.69	.512	.57	220
July	3.17	1.81	2.39	.332	.38	147
August	12.5	2.63	7.64	1.06	1.22	470
September	16.6	4.20	7.39	1.03	1.15	440
The year	16.6	1.10	3.78	.525	7.12	2,750

NOTE.—Attention is called to the fact that the monthly discharge in second-feet per square mile and the run-off depth in inches do not represent the natural flow from the basin because of artificial storage. The mean of the yearly discharges represents closely the mean natural run-off for the period as effect of storage is eliminated.

LITTLE BEAVER CREEK NEAR PIKES PEAK, COLO.

Location.—In the NW. ¼ of NW. ¼, sec. 32, T. 14 S., R. 68 W., just above mouth of creek 3½ miles south of Pikes Peak, El Paso County, Little Beaver Creek enters Boehmer Creek from the west 0.3 mile above reservoir No. 4. Elevation of station, 11,000 feet.

Drainage area.—1.00 square mile (measured on topographic map). Approximately 25 per cent of area above timber line; remainder sparsely timbered.

Records available.—October 1, 1909, to September 30, 1916.

Determination of discharge.—Flow measured by sharp-crested weir, 24 inches long, with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

Diversions.—None.

Regulation.—None.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Little Beaver Creek near Pikes Peak, Colo., for the year ending Sept. 30, 1910–1916.

Month.	Discharge in second-feet.				Depth in inches on drainage area.	Total in acre-feet.
	Maximum.	Minimum.	Mean.	Per square mile.		
1909–10.						
October	0.72	0.36	0.51	0.51	0.59	31.4
November	.36	.16	.28	.28	.31	16.7
December	.36	.22	.27	.27	.31	16.6
January	.36	.36	.36	.36	.42	22.1
February	.36	.22	.23	.23	.24	12.8
March	.29	.24	.24	.24	.28	14.8
April	.36	.29	.30	.30	.33	17.9
May	9.26	3.64	6.44	6.44	7.42	396
June	.94	.46	.71	.71	.79	42.2
July	.46	.10	.20	.20	.23	12.3
August	.30	.30	.30	.30	.35	18.4
September	.20	.20	.20	.20	.22	11.9
The year	9.26	.10	.85	.85	11.49	613
1910–11.						
October	.16	.16	.16	.16	.18	9.8
November	.16	.16	.16	.16	.18	9.5
December	.10	.10	.10	.10	.12	6.1
January	.06	.06	.06	.06	.07	3.7
February	.06	.06	.06	.06	.06	3.3
March	.06	.06	.06	.06	.07	3.7
April	1.04	.19	.69	.69	.77	41.1
May	1.78	.22	1.13	1.13	1.30	69.5
June	1.65	1.10	1.37	1.37	1.53	81.5
July	1.40	1.00	1.27	1.27	1.46	78.1
August	1.28	.54	1.02	1.02	1.18	62.7
September	.72	.45	.53	.53	.59	31.5
The year	1.78	.06	.55	.55	7.51	400
1911–12.						
October	.46	.16	.35	.35	.40	21.5
November	.22	.16	.21	.21	.23	12.5
December	.16	.16	.16	.16	.18	9.8
January	.16	.16	.16	.16	.18	9.8
February	.00	.00	.00	.00	.00	.0
March	.16	.16	.16	.16	.18	9.8
April	.00	.00	.00	.00	.00	.0
May	.76	.76	.76	.76	.88	46.7
June	3.10	1.00	2.14	2.14	2.39	127
July	1.53	.63	.89	.89	1.03	54.7
August	.93	.45	.63	.63	.73	38.7
September	.63	.22	.31	.31	.35	18.4
The year	3.10	.00	.48	.48	6.55	349

Monthly discharge of Little Beaver Creek near Pikes Peak, Colo., for the year ending Sept 30, 1910–1916—Continued.

Month.	Discharge in second-feet.				Depth in inches on drainage area.	Total in acre-feet.
	Maximum.	Minimum.	Mean.	Per square mile.		
1912–13.						
October	0.29	0.10	0.21	0.21	0.24	12.
November	.19	.06	.11	.11	.12	6.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	1.00	.00	.36	.36	.42	22.
June	2.50	1.28	1.71	1.71	1.91	102
July	5.00	.63	1.20	1.20	1.38	73.
August	1.00	.63	.75	.75	.86	46.
September	.93	.45	.55	.55	.61	32.
The year	5.00	.00	.41	.41	5.54	296
1913–14.						
October	.65	.40	.54	.54	.62	33.
November	.54	.22	.34	.34	.38	20.
December	.10	.10	.10	.10	.12	6.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	5.00	.00	1.73	1.73	1.99	106
June	8.36	2.73	5.70	5.70	6.36	339
July	3.62	1.28	2.17	2.17	2.50	133
August	3.28	1.28	2.30	2.30	2.65	141
September	1.28	.29	.64	.64	.71	38.
The year	8.36	.00	1.13	1.13	15.33	817
1914–15.						
October	.45	.22	.34	.34	.39	20.
November	.29	.00	.24	.24	.27	14.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	2.34	.00	.83	.83	.96	51.
June	10.2	3.28	5.71	5.71	6.37	340
July	3.28	.93	1.57	1.57	1.81	96.
August	1.28	.63	.94	.94	1.08	57.
September	.63	.45	.54	.54	.60	32.
The year	10.2	.00	.85	.85	11.48	613
1915–16.						
October	.54	.16	.41	.41	.47	25.
November	.10	.10	.10	.10	.11	6.
December	.06	.00	.02	.02	.02	1.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.06	.00	.02	.02	.02	1.
April	.06	.06	.06	.06	.07	3.
May	1.60	.06	.45	.45	.52	27.
June	.81	.81	.81	.81	.90	48.
July	.63	.36	.49	.49	.56	30.
August	.72	.45	.56	.56	.65	34.
September	.45	.29	.33	.33	.37	19.
The year	1.60	.00	.27	.27	3.67	197

SACKETT CREEK NEAR PIKES PEAK, COLO.

Location.—In the SE. ¼ NW. ¼ sec. 32, T. 14 S., R. 68 W., just above mouth of creek, 4 miles southeast of Pikes Peak, El Paso County. Sackett Creek enters Boehmer Creek from the north a short distance above reservoir No. 4. Elevation of station, 11,000 feet.

Drainage area.—0.65 square mile (measured on topographic map). Approximately 30 per cent of area above timber line, and remainder sparsely timbered.

Records available.—October 1, 1909, to September 30, 1916.

Determination of discharge.—Flow measured by sharp-crested weir 24 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

Diversions.—None.

Regulation.—None.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Sackett Creek near Pikes Peak, Colo., for the years ending Sept. 30, 1910–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1909–10.						
October	0.87	0.22	0.66	1.01	1.16	40.6
November	.70	.12	.29	.447	.50	17.3
December	.22	.22	.22	.338	.39	13.5
January	.22	.22	.22	.338	.39	13.5
February	.22	.12	.15	.231	.24	8.3
March	.34	.20	.23	.354	.41	14.1
April	1.76	.34	.55	.846	.94	32.7
May	2.73	.96	1.58	2.43	2.80	97.2
June	1.65	.40	1.03	1.58	1.76	61.3
July	.40	.12	.17	.261	.30	10.5
August	.87	.12	.39	.600	.69	24.0
September	.22	.22	.22	.338	.38	13.1
The year	2.73	.12	.48	.734	9.96	346
1910–11.						
October	.12	.12	.12	.184	.21	7.4
November	.10	.10	.10	.154	.17	6.0
December	.10	.10	.10	.154	.18	6.1
January	.00	.00	.00	.00	.00	.0
February	.00	.00	.00	.00	.00	.0
March	.00	.00	.00	.00	.00	.0
April	.22	.22	.22	.338	.38	13.1
May	6.28	.22	1.59	2.45	2.82	97.8
June	1.14	.55	.78	1.20	1.34	46.4
July	2.13	.34	1.14	1.75	2.02	70.1
August	7.35	.50	1.27	1.95	2.25	78.1
September	.49	.22	.34	.523	.58	20.2
The year	6.28	.00	.48	.733	9.95	345
1911–12.						
October	.30	.06	0.14	.215	0.25	8.6
November	.36	.36	.36	.553	.62	21.4
December	.00	.00	.00	.00	.00	.0
January	.00	.00	.00	.00	.00	.0
February	.00	.00	.00	.00	.00	.0
March	.06	.06	.06	.0923	.11	3.7
April	.00	.00	.00	.00	.00	.0
May	.76	.76	.76	1.17	1.35	46.7
June	3.10	1.28	2.06	3.17	3.54	123
July	1.65	.54	.89	1.37	1.58	54.7
August	1.10	.29	.54	.831	.96	33.2
September	1.88	.19	.32	.492	.55	19.0
The year	3.10	.00	.43	.657	8.96	310

Monthly discharge of Sackett Creek near Pikes Peak, Colo., for the years ending Sept. 30, 1910–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1912–13.						
October	0.26	0.06	0.15	0.231	0.27	9.
November	.06	.06	.06	.0923	.10	3.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	1.10	.00	.58	.892	1.03	35.
June	1.65	.63	.89	1.37	1.53	53.
July	3.62	.36	.85	1.31	1.51	52.
August	.72	.45	.55	.846	.98	33.
September	.54	.36	.47	.723	.81	28.
The year	3.62	.00	.30	.458	6.23	216
1913–14.						
October	.63	.16	0.40	.615	0.71	24.
November	.36	.06	.23	.354	.40	13.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	5.83	.00	1.99	3.06	3.53	122
June	6.64	1.65	3.18	4.89	5.46	189
July	2.34	.82	1.48	2.28	2.63	91.
August	2.64	1.53	1.93	2.97	3.42	119
September	1.28	.16	.41	.631	.70	24.
The year	6.64	.00	.81	1.24	16.85	584
1914–15.						
October	.45	.10	0.17	.261	0.30	10.
November	.10	.06	.07	.108	.12	4.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.00	.00	.00	.00	.00	.
April	.00	.00	.00	.00	.00	.
May	5.00	.00	1.65	2.54	2.93	101
June	7.49	1.53	3.34	5.14	5.74	199
July	2.00	.54	.98	1.51	1.74	60.
August	1.00	.45	.69	1.06	1.22	42.
September	.45	.45	.45	.692	.77	26.
The year	7.49	.00	.61	.944	12.82	444
1915–16.						
October	.29	.06	.22	.338	.39	13.
November	.06	.00	.02	.0307	.03	1.
December	.00	.00	.00	.00	.00	.
January	.00	.00	.00	.00	.00	.
February	.00	.00	.00	.00	.00	.
March	.06	.00	.02	.0307	.04	1.
April	.06	.06	.06	.0923	.10	3.
May	1.78	.06	.83	1.28	1.48	51.
June	1.00	.63	.97	1.49	1.66	57.
July	.36	.16	.20	.307	.35	12.
August	.36	.16	.15	.231	.27	9.
September	.10	.10	.10	.154	.17	6.
The year	1.78	.00	.21	.330	4.49	156

LION CREEK NEAR HALFWAY, COLO.

Location.—In the NW. ¼ sec. 15, T. 14 S., R. 68 W., at mouth of creek half a mile southwest of Halfway, El Paso County. Lion Creek enters Ruxton Creek from the west. Elevation of station, 9,250 feet.

Drainage area.—2.00 square miles (measured on topographic map). Includes all area above the crater apparently tributary to Sheep Creek. Approximately 30 per cent of area above timber line, and remainder sparsely timbered.

Records available.—April 1, 1908, to September 30, 1916.

Determination of discharge.—Flow measured by sharp-crested weir 30 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

Diversions.—None.

Regulation.—None.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Lion Creek near Halfway, Colo., for the years ending Sept. 30, 1908–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
April	1.06	0.45	0.65	0.325	0.36	38.7
May	.80	.37	.60	.300	.35	36.9
June	52	.30	.43	.215	.24	25.6
July	.92	.27	.46	.230	.27	28.3
August	1.60	.41	.78	.390	.45	48.0
September	1.02	.45	.71	.355	.40	42.2
The period						220
1908-9.						
October	.96	.74	.89	.445	.51	54.7
November	.87	.60	.75	.375	.42	44.6
December	.74	.60	.65	.325	.37	40.0
January	.65	.56	.58	.290	.33	35.7
February	.65	.48	.58	.290	.30	32.2
March	.65	.56	.61	.305	.35	37.5
April	1.38	.60	.78	.390	.44	46.4
May	1.16	.74	.86	.430	.50	52.9
June	1.08	.48	.73	.365	.41	43.4
July	.91	.45	.59	.295	.34	36.3
August	1.71	.56	1.00	.500	.58	61.5
September	3.90	1.27	2.37	1.18	1.32	141
The year	3.90	.45	.86	.432	5.87	626
1909-10.						
October	2.27	1.49	1.87	.935	.108	115
November	1.49	.87	1.26	.630	.70	75.0
December	1.08	.92	1.00	.500	.58	61.5
January	.96	.74	.86	.430	.50	52.9
February	.87	.69	.76	.380	.40	42.2
March	1.43	.48	.91	.455	.52	56.0
April	1.16	.69	1.00	.500	.56	59.5
May	1.27	1.02	1.09	.545	.63	67.0
June	1.38	.78	.87	.435	.49	51.8
July	1.60	.69	.94	.470	.54	57.8
August	1.43	.87	1.12	.560	.65	68.9
September	1.38	1.06	1.22	.610	.68	72.6
The year	2.27	.48	1.08	.539	7.33	780
1910-11.						
October	1.22	.87	1.03	.515	.59	63.3
November	.69	.45	.56	.280	.31	33.3
December	.69	.24	.60	.300	.35	36.9
January	56	.41	.50	.250	.29	30.7
February	.48	.21	.40	.200	.21	22.2
March	.65	.21	.43	.215	.25	26.4
April	1.06	.37	.57	.285	.32	33.9
May	.56	.37	.46	.230	.27	28.3
June	1.06	.27	.38	.190	.21	22.6
July	.69	.30	.53	.265	.31	32.6
August	2.67	.41	1.36	.680	.78	83.6
September	1.60	1.10	1.32	.660	.74	78.6
The year	2.67	.21	.68	.340	4.63	492

Monthly discharge of Lion Creek near Halfway, Colo., for the years ending Sept. 30, 1908–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1911–12.						
October	1.60	0.97	1.11	0.555	0.64	68.2
November	1.10	.79	.95	.475	.53	56.5
December	.91	.67	.78	.390	.45	48.0
January	.73	.61	.65	.325	.37	40.0
February	.67	.51	.60	.300	.32	34.5
March	.87	.56	.66	.330	.38	40.6
April	2.10	.61	1.07	.535	.60	63.7
May	3.31	.85	1.40	.700	.81	86.1
June	3.41	.91	1.33	.665	.74	79.1
July	2.23	.91	1.43	.715	.82	87.9
August	2.38	1.63	1.95	.975	1.12	120
September	2.10	1.38	1.54	.770	.86	91.6
The year	3.41	.51	1.12	.562	7.64	816
1912–13.						
October	1.60	1.10	1.32	.660	.76	81.2
November	1.24	.79	1.02	.510	.57	60.7
December	.85	.27	.62	.310	.36	38.1
January	.79	.46	.65	.325	.37	40.0
February	.73	.61	.67	.335	.35	37.2
March	1.75	.46	.61	.305	.35	37.5
April	2.40	.56	1.20	.600	.67	71.4
May	2.75	.67	.95	.475	.55	58.4
June	1.10	.46	.70	.350	.39	41.7
July	2.75	.36	.62	.310	.36	38.1
August	2.10	.56	1.08	.540	.62	66.4
September	1.90	1.03	1.37	.685	.76	81.5
The year	2.75	.27	.90	.450	6.11	652
1913–14.						
October	1.63	1.10	1.40	.700	.81	86.1
November	1.30	1.03	1.12	.560	.62	66.6
December	1.03	.79	.93	.465	.54	57.2
January	.79	.67	.72	.300	.42	44.3
February	.79	.61	.65	.325	.34	36.1
March	.85	.61	.70	.350	.40	43.0
April	2.07	.85	1.38	.690	.77	82.1
May	5.17	1.75	2.28	1.14	1.31	140
June	5.62	1.63	2.49	1.24	1.38	148
July	4.21	2.41	3.39	1.70	1.96	208
August	4.31	2.98	3.70	1.85	2.13	228
September	2.93	1.90	2.40	1.20	1.34	143
The year	5.62	.61	1.77	.883	12.02	1,280
1914–15.						
October	2.10	1.63	1.79	.895	1.03	110
November	1.75	1.17	1.45	.725	.81	86.
December	1.30	.97	1.08	.540	.62	66.4
January	1.03	.67	.86	.430	.50	52.
February	.91	.73	.80	.400	.42	44.
March	.97	.61	.76	.380	.44	46.
April	2.93	.67	1.19	.595	.66	70.
May	2.93	1.63	2.09	1.04	1.20	129
June	2.23	1.60	1.86	.930	1.04	111
July	2.93	1.83	2.26	1.13	1.30	139
August	3.31	1.90	2.55	1.28	1.48	157
September	2.75	1.90	2.22	1.11	1.24	132
The year	3.31	.61	1.58	.787	10.74	1,150
1915–16.						
October	2.07	1.38	1.68	.840	0.97	103
November	1.45	1.17	1.28	.640	.71	76.
December	1.17	.91	1.04	.520	.60	64.
January	.97	.67	.85	.425	.49	52.
February	.91	.67	.78	.390	.42	44.
March	1.03	.56	.76	.380	.44	46.
April	1.17	.67	.88	.440	.49	52.
May	1.45	.79	1.15	.575	.66	70.
June	1.03	.56	.76	.380	.42	45.
July	6.32	.51	.97	.485	.56	59.
August	1.90	1.10	1.45	.725	.84	89.
September	1.63	1.17	1.46	.730	.81	86.
The year	6.32	.51	1.09	.545	7.41	791

SHEEP CREEK NEAR HALFWAY, COLO.

Location.—In the SW. ¼ sec. 11, T. 14 S., R. 68 W., a quarter of a mile west of Halfway, El Paso County. No tributary between station and mouth a short distance below. Sheep Creek enters Ruxton Creek from the west a short distance above Halfway. Elevation of station, 9,100 feet.

Drainage area.—0.73 square mile (measured on topographic map). Does not include any area above the Crater as this is most probably tributary to Lion Creek. Practically all below timber line, but sparsely timbered.

Records available.—April 1, 1908, to September 30, 1916.

Determination of discharge.—Flow measured by sharp-crested weir 30 inches long with complete end contraction. A stake is driven into bed of stream in pool above weir, so that its head is level with crest of weir; depth of water over stake is measured by steel scale. Discharge is computed by Francis formula.

Diversions.—None.

Regulation.—None.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Sheep Creek near Halfway, Colo., for the years ending Sept. 30, 1908–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
April	0.30	0.18	0.27	0.369	0.41	16.1
May	.45	.26	.46	.629	.73	28.3
June	.30	.16	.23	.315	.35	13.7
July	.24	.13	.18	.246	.28	11.1
August	1.27	.15	.51	.698	.80	31.4
September	.56	.45	.48	.656	.73	28.6
The period						129
1908–9.						
October	.45	.27	.33	.451	.52	20.8
November	.27	.18	.22	.301	.34	13.1
December	.24	.21	.22	.301	.35	13.5
January	.24	.21	.21	.287	.33	12.9
February	.24	.13	.16	.219	.23	8.9
March	.18	.13	.14	.192	.22	8.6
April	.52	.15	.25	.342	.38	14.9
May	.48	.26	.34	.465	.54	20.9
June	.41	.21	.32	.438	.49	19.0
July	.52	.18	.28	.383	.44	17.2
August	.96	.30	.63	.862	.99	38.7
September	2.20	.92	1.47	2.01	2.24	87.5
The year	2.20	.13	.38	.521	7.07	276
1909–10.						
October	1.06	.52	.79	1.08	1.24	48.6
November	.52	.18	.44	.602	.67	26.2
December	.37	.27	.30	.411	.47	18.4
January	.24	.21	.23	.315	.36	14.1
February	.21	.18	.18	.246	.26	10.0
March	.60	.18	.34	.465	.54	20.9
April	.65	.24	.46	.629	.70	27.4
May	.69	.52	.62	.848	.98	38.1
June	.60	.30	.45	.616	.69	26.8
July	.78	.41	.47	.643	.74	28.9
August	.82	.45	.63	.862	.99	38.7
September	.65	.45	.54	.739	.82	32.1
The year	1.06	.18	.46	.624	8.46	330

Monthly discharge of Sheep Creek near Halfway, Colo., for the years ending Sept. 30, 1908–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1910–11.						
October	0.48	0.37	0.40	0.547	0.63	24.6
November	.37	.21	.31	.424	.47	18.4
December	.30	.24	.27	.369	.43	16.6
January	.30	.13	.20	.273	.31	12.3
February	.13	.08	.10	.137	.14	5.6
March	.13	.08	.11	.150	.17	6.8
April	.41	.13	.22	.301	.34	13.1
May	.45	.18	.28	.383	.44	17.2
June	.37	.08	.15	.205	.23	8.9
July	.69	.08	.35	.478	.55	21.5
August	1.60	.61	.82	1.12	1.29	50.4
September	.73	.51	.57	.780	.87	33.9
The year	1.60	.08	.32	.433	5.87	229
1911–12.						
October	.73	.41	.51	.698	.80	31.4
November	.46	.32	.37	.506	.56	22.0
December	.36	.23	.29	.397	.46	17.8
January	.23	.16	.20	.274	.32	12.3
February	.16	.13	.15	.205	.22	8.6
March	.27	.16	.20	.274	.32	12.3
April	1.03	.20	.39	.533	.59	23.2
May	2.93	.56	1.23	1.68	1.94	75.6
June	2.23	.79	1.27	1.74	1.94	75.6
July	1.98	1.03	1.32	1.81	2.09	81.2
August	1.63	.91	1.31	1.79	2.06	80.6
September	1.10	.67	.80	1.09	1.22	47.6
The year	2.93	.13	.67	.920	12.52	488
1912–13.						
October	1.45	.51	.64	.876	1.01	39.4
November	.56	.36	.44	.602	.67	26.2
December	.36	.13	.25	.342	.39	15.4
January	.20	.13	.17	.233	.27	10.5
February	.13	.10	.13	.178	.19	7.2
March	.51	.05	.16	.219	.25	9.8
April	1.38	.23	.64	.876	.98	38.1
May	1.24	.46	.63	.862	.99	38.7
June	.79	.32	.49	.671	.75	29.2
July	1.17	.20	.45	.616	.71	27.7
August	1.03	.46	.65	.890	1.03	40.0
September	1.03	.56	.73	1.00	1.12	43.4
The year	1.45	.05	.45	.615	8.36	326
1913–14.						
October	.91	.56	.67	.917	1.06	41.2
November	.56	.32	.43	.588	.66	25.6
December	.36	.27	.33	.451	.52	20.3
January	.27	.23	.26	.356	.41	16.0
February	.27	.20	.22	.301	.31	12.2
March	.36	.23	.29	.397	.46	17.8
April	1.75	.36	1.01	1.38	1.54	60.1
May	3.31	1.10	2.33	3.19	3.68	143
June	2.57	1.52	2.13	2.91	3.25	127
July	3.70	1.83	2.69	3.68	4.24	165
August	3.31	1.10	2.14	2.93	3.38	132
September	1.45	.79	1.03	1.41	1.57	61.3
The year	3.70	.20	1.13	1.55	21.08	822

Monthly discharge of Sheep Creek near Halfway, Colo., from the years ending Sept. 30, 1908–1916—Colorado.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1914–15.						
October	0.79	0.56	0.72	0.986	1.14	44.3
November	.67	.36	.53	.725	.81	31.5
December	.46	.27	.34	.465	.54	20.9
January	.32	.23	.25	.342	.39	15.4
February	.20	.16	.20	.274	.29	11.1
March	.36	.20	.23	.315	.36	14.1
April	3.06	.27	.96	1.31	1.46	57.1
May	3.12	1.38	2.11	2.88	3.32	130
June	2.84	1.03	1.80	2.46	2.74	107
July	1.83	1.10	1.41	1.93	2.22	86.7
August	2.10	1.30	1.71	2.34	2.70	105
September	1.75	1.03	1.25	1.71	1.91	74.4
The year	3.12	.16	.96	1.32	17.88	698
1915–16.						
October	.97	.67	.79	1.08	1.24	48.6
November	.67	.46	.54	.739	.82	32.1
December	.46	.27	.36	.492	.57	22.1
January	.36	.23	.26	.356	.41	16.0
February	.27	.23	.24	.328	.35	13.8
March	.27	.20	.24	.328	.38	14.8
April	1.03	.23	.41	.561	.63	24.4
May	1.38	.73	1.10	1.50	1.73	67.6
June	.91	.27	.54	.739	.82	32.1
July	4.52	.27	.57	.780	.90	35.0
August	2.40	.97	1.22	1.67	1.92	75.0
September	1.03	.67	.79	1.08	1.21	47.0
The year	4.52	.20	.59	.807	10.98	428

SOUTH RUXTON CREEK AT HALFWAY, COLO.

Location.—In the SW. ¼ sec. 11, T. 14 S., R. 68 W., just above hydroelectric intake at Halfway, El Paso County. No surface tributary between station and mouth, a short distance below. South Ruxton Creek enters Ruxton Creek from the south at Halfway. Elevation of station, 9,000 feet.

Drainage area.—3.95 square miles (measured on topographic map). Practically all below timber line and heavily timbered.

Records available.—June 1, 1906, to September 30, 1916.

Determination of discharge.—Flow measured by two sharp-crested weirs, with complete end contraction. Discharge is computed by Francis formula. The main weir is one-third mile above the mouth of the creek and a short distance above the hydroelectric intake which has a capacity of 4.63 second-feet. The second weir is halfway between the main weir and the mouth of the creek and measures the inflow chiefly from springs below the intake and a small amount of seepage. At all times except during high water the capacity of the intake is sufficient to take the entire flow passing the main weir, and the flow at the two weirs is combined to give the total run-off of the basin. During high water the excess passing the intake and recorded at the lower weir does not represent increased flow between the weirs, and is discarded. In its place is used a constant quantity based on inflow and seepage at other times.

Diversions.—None.

Regulation.—None.

Coöperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of South Ruxton Creek at Halfway, Colo., for the years ending Sept. 30, 1906–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1906.						
June	3.50	1.60	2.23	0.565	0.63	133
July	6.08	1.90	3.59	.909	1.05	221
August	3.70	2.57	2.95	.746	.86	181
The period	....	....	....	....	....	535
1906–7.						
October	2.93	1.30	2.04	.516	.59	125
November	3.70	2.07	2.86	.724	.81	170
December	2.40	1.45	1.85	.468	.54	114
January	1.45	1.17	1.34	.339	.39	82.4
February	1.30	.79	1.09	.276	.29	60.5
March	1.30	.67	1.00	.253	.29	61.5
April	1.75	.79	1.18	.299	.33	70.2
May	3.12	1.17	2.35	.595	.69	144
June	5.40	2.49	3.89	.985	1.10	231
July	5.17	2.07	2.57	.651	.75	158
August	5.40	2.38	3.50	.887	1.02	215
September	2.40	1.75	1.96	.496	.55	117
The year	5.40	.67	2.11	.541	7.35	1,550
1907–8.						
October	1.90	1.30	1.50	.380	0.44	92.2
November	1.98	1.03	1.19	.301	.34	70.8
December	1.03	.79	.91	.231	.27	56.0
January	1.45	.73	.86	.218	.25	52.9
February	.84	.67	.74	.188	.20	42.0
March	1.17	.67	.83	.210	.24	51.6
April	1.45	.36	.93	.236	.26	55.3
May	1.38	.28	.87	.220	.25	53.5
June	.79	.56	.70	.177	.20	41.7
July	2.00	.67	1.17	.296	.34	71.9
August	7.29	2.00	4.30	1.09	1.26	264
September	4.95	2.07	2.90	.734	.82	173
The year	7.29	.28	1.41	.357	4.87	1,020
1908–9.						
October	2.07	1.39	1.60	.405	.47	98.4
November	1.75	.85	1.22	.309	.34	72.6
December	1.17	.97	1.04	.263	.30	64.0
January	1.03	.91	.97	.246	.28	59.6
February	.98	.91	.95	.241	.25	52.8
March	1.10	.91	.95	.241	.28	58.4
April	1.90	.98	1.31	.332	.37	78.0
May	2.40	1.45	1.96	.496	.57	121
June	3.06	2.10	2.51	.635	.71	149
July	2.84	1.83	2.14	.542	.62	132
August	4.73	2.24	3.14	.795	.92	193
September	10.1	4.10	6.15	1.56	1.74	366
The year	10.1	.85	1.99	.505	6.85	1,440
1909–10.						
October	3.90	2.10	2.88	.729	.84	177
November	2.24	.98	1.81	.458	.51	108
December	1.60	.98	1.43	.362	.42	87.9
January	1.38	1.17	1.27	.321	.37	78.1
February	1.17	.98	1.06	.268	.28	58.9
March	2.07	.98	1.25	.316	.36	76.9
April	2.94	1.17	1.80	.456	.51	107
May	3.60	2.58	3.08	.780	.90	189
June	4.31	2.58	3.31	.838	.94	197
July	2.84	2.07	2.48	.628	.72	152
August	3.90	2.40	2.89	.732	.84	178
September	2.76	1.60	2.08	.527	.59	124
The year	4.31	.98	2.12	.535	7.28	1,530

Monthly discharge of South Ruxton Creek at Halfway, Colo., for the years ending Sept. 30, 1906–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1910–11.						
October	1.75	1.38	1.56	0.395	0.46	95.9
November	1.52	1.17	1.28	.324	.36	76.2
December	1.24	.98	1.08	.273	.31	66.4
January	1.10	.85	1.00	.253	.29	61.5
February	1.03	.73	.91	.231	.24	50.5
March	1.30	.67	.96	.243	.28	59.0
April	1.60	.41	1.10	.279	.31	65.5
May	1.52	1.30	1.44	.365	.42	88.5
June	1.75	1.24	1.37	.347	.39	81.5
July	4.95	1.45	2.35	.595	.69	144
August	4.52	1.75	2.52	.638	.74	155
September	1.90	1.24	1.49	.377	.42	88.7
The year	4.95	.41	1.43	.360	4.91	1,030
1911–12.						
October	1.52	.91	1.19	.301	.35	73.2
November	1.30	.85	.98	.248	.28	58.3
December	.97	.74	.79	.200	.23	48.6
January	.79	.67	.73	.185	.21	44.9
February	.79	.61	.67	.170	.18	38.5
March	.79	.61	.68	.172	.20	41.8
April	1.63	.61	.99	.251	.28	58.9
May	4.31	1.17	2.52	.638	.74	155
June	6.80	2.67	3.95	1.00	1.12	235
July	5.18	2.76	3.33	.843	.97	205
August	3.50	2.07	2.80	.708	.82	172
September	2.23	1.60	1.78	.451	.50	106
The year	6.80	.61	1.69	.431	5.88	1,240
1912–13.						
October	1.90	1.24	1.42	.359	.41	87.3
November	1.52	.98	1.16	.293	.33	69.0
December	.98	.73	.87	.220	.25	53.5
January	.85	.73	.74	.188	.22	45.5
February	.73	.67	.71	.180	.19	39.4
March	1.63	.56	.72	.182	.21	44.3
April	1.75	.67	1.15	.291	.32	68.4
May	2.10	1.17	1.40	.355	.41	86.1
June	3.31	1.24	2.20	.558	.62	131
July	4.21	1.60	2.53	.641	.74	156
August	3.50	1.63	2.48	.628	.72	152
September	3.60	2.67	3.05	.772	.86	181
The year	4.21	.56	1.54	.389	5.28	1,110
1913–14.						
October	2.93	1.60	1.95	.494	0.57	120
November	1.75	.97	1.36	.345	.38	80.9
December	1.52	1.03	1.20	.304	.35	73.8
January	1.45	.97	1.03	.261	.30	63.3
February	1.03	.85	.90	.228	.24	50.0
March	1.17	.73	.97	.246	.28	59.6
April	4.52	1.17	2.91	.736	.82	173
May	9.37	3.90	7.25	1.84	2.12	446
June	11.5	7.67	9.60	2.43	2.71	571
July	8.38	5.62	6.72	1.70	1.96	413
August	8.31	4.10	5.72	1.45	1.67	352
September	4.00	2.57	3.28	.831	.93	195
The year	11.5	.73	3.50	.905	12.33	2,600

Monthly discharge of South Ruxton Creek at Halfway, Colo., for the years ending Sept. 30, 1906–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1914–15.						
October	2.57	1.83	2.28	0.578	0.67	140
November	2.38	1.24	1.87	.474	.53	111
December	1.75	1.30	1.48	.375	.43	91.0
January	1.30	1.17	1.25	.316	.36	76.9
February	1.30	1.03	1.13	.286	.30	62.8
March	1.10	.97	1.02	.258	.30	62.7
April	4.73	1.10	2.09	.530	.59	124
May	9.37	3.90	6.41	1.62	1.87	394
June	10.1	7.38	8.94	2.26	2.52	532
July	7.17	4.10	4.96	1.26	1.45	305
August	5.97	4.52	5.38	1.36	1.57	331
September	5.28	3.06	3.78	.957	1.07	225
The year	10.1	.97	3.39	.856	11.66	2,460
1915–16.						
October	3.06	2.38	2.70	.683	.79	166
November	2.40	1.63	1.94	.491	.55	115
December	1.75	1.31	1.56	.395	.46	95.9
January	1.45	1.17	1.30	.329	.38	79.9
February	1.45	1.03	1.20	.304	.33	69.0
March	1.52	.61	1.12	.284	.33	68.9
April	2.57	.73	1.40	.355	.40	83.3
May	3.90	1.98	3.15	.798	.92	194
June	3.70	2.10	2.76	.698	.78	164
July	3.70	1.83	2.04	.517	.60	125
August	6.44	3.70	5.16	1.31	1.51	317
September	4.41	2.40	3.25	.824	.92	193
The year	6.44	.61	2.30	.582	7.97	1,670

CABIN CREEK NEAR HALFWAY, COLO.

Location.—In the SW. ¼ NW. ¼ sec. 11, T. 14 S., R. 68 W., just above hydroelectric intake, about three-eighths mile north of Halfway, El Paso County. Cabin Creek enters Ruxton Creek half a mile below Halfway. Elevation of station, approximately 9,000 feet.

Drainage area. 2.4 square miles (measured on topographic map). Approximately 15 per cent of area above timber line and remainder sparsely timbered.

Records available. October 1, 1906, to September 30, 1916.

Determination of discharge.—Flow measured by two sharp-crested weirs with complete end contraction. Discharge is computed by Francis formula. The main weir is about one-third of a mile above the mouth of the creek and just above the hydroelectric intake. The second weir is 50 feet above the mouth of the creek and measures the flow from springs and small tributaries entering below the intake. Except during high water the measured flow at the weirs is combined to give the total run-off from the basin. During high water the record from the lower weir is discarded and the inflow estimated. (See description of South Ruxton Creek at Halfway, Colo.)

Diversions.—None.

Regulation.—None.

Cooperation.—Monthly discharge computed from records collected by Colorado Springs Water Department.

Monthly discharge of Cabin Creek near Halfway, Colo., for the year ending Sept. 30, 1907–1916.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1906–7.						
October	4.10	2.57	3.24	1.35	1.56	199
November	3.50	1.60	2.38	.992	1.11	142
December	1.60	.91	1.19	.496	.57	73.2
January	1.45	.51	.70	.292	.34	43.0
February	.67	.46	.56	.233	.24	31.1
March	.61	.46	.50	.208	.24	30.7
April	1.30	.46	.68	.283	.32	40.5
May	2.07	1.10	1.67	.696	.80	103
June	3.06	.97	1.71	.713	.80	102
July	4.10	.85	1.29	.538	.62	79.3
August	2.75	1.45	1.96	.816	.94	121
September	1.45	.91	1.04	.434	.48	61.9
The year	4.10	.46	1.42	.590	8.02	1,030
1907–8.						
October	1.17	.79	.87	.363	.42	53.5
November	.85	.41	.56	.233	.26	33.3
December	.46	.36	.40	.167	.19	24.6
January	.36	.16	.28	.117	.13	17.2
February	.23	.10	.19	.0792	.09	10.9
March	.79	.20	.32	.133	.15	19.7
April	.67	.27	.38	.158	.18	22.6
May	.85	.41	.52	.217	.25	32.0
June	.46	.20	.32	.133	.15	19.0
July	.61	.10	.30	.125	.14	18.4
August	2.57	.27	1.14	.475	.55	70.1
September	2.07	1.17	1.45	.604	.67	86.3
The year	2.57	.10	.58	.242	3.19	408
1908–9.						
October	1.24	.67	.86	.359	.41	52.9
November	.73	.32	.51	.213	.24	30.3
December	.33	.27	.32	.133	.15	19.7
January	.27	.20	.25	.104	.12	15.4
February	.34	.13	.22	.0917	.10	12.2
March	.32	.20	.22	.0917	.11	13.5
April	1.24	.27	.61	.254	.28	36.3
May	1.24	.73	.93	.388	.45	57.2
June	2.28	1.10	1.54	.642	.72	91.6
July	1.39	.67	.98	.408	.47	60.3
August	3.41	.67	1.91	.796	.92	117
September	6.32	2.57	4.04	1.68	1.87	240
The year	6.32	.13	1.02	.431	5.83	746
1909–10.						
October	2.57	1.24	1.77	.737	.85	109
November	1.17	.56	.79	.329	.37	47.0
December	.61	.36	.48	.200	.23	29.5
January	.41	.23	.30	.125	.14	18.4
February	.46	.16	.33	.138	.14	18.3
March	1.03	.32	.60	.250	.29	36.9
April	1.52	.56	1.01	.421	.47	60.1
May	1.98	1.45	1.67	.696	.80	103
June	2.07	1.17	1.51	.629	.70	89.8
July	1.90	.91	1.29	.538	.62	79.3
August	1.60	.97	1.27	.529	.61	78.1
September	1.60	1.10	1.35	.562	.63	80.3
The year	2.57	.16	1.04	.431	5.85	750
1910–11.						
October	1.38	.91	1.07	.446	.51	65.8
November	1.03	.67	.85	.355	.40	50.6
December	.73	.51	.62	.258	.30	38.1
January	.56	.41	.52	.217	.25	32.0
February	.34	.21	.29	.121	.13	16.1
March	.61	.46	.51	.213	.25	31.4
April	1.10	.56	.75	.313	.35	44.6
May	1.17	.73	.99	.418	.48	60.9
June	2.23	.61	.89	.371	.41	53.0
July	4.31	.61	1.87	.779	.90	115
August	3.70	1.63	2.74	1.14	1.31	168
September	1.83	1.17	1.38	.575	.64	82.1
The year	4.31	.21	1.05	.437	5.93	758

Monthly discharge of Cabin Creek near Halfway, Colo., for the year ending Sept. 30, 1907–1916—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1911–12.						
October	1.90	0.85	1.10	0.458	0.53	67.6
November	1.03	.67	.82	.342	.38	48.8
December	.73	.56	.64	.267	.31	39.4
January	.51	.16	.31	.129	.15	19.1
February	.32	.13	.22	.0917	.10	12.7
March	.73	.27	.39	.162	.19	24.0
April	2.93	.46	.93	.388	.43	55.3
May	6.08	1.10	2.92	1.22	1.41	180
June	7.04	2.93	4.22	1.76	1.96	251
July	5.40	2.93	3.77	1.57	1.81	232
August	4.95	2.23	3.57	1.49	1.72	220
September	2.40	1.30	1.74	.725	.81	104
The year	7.04	.13	1.73	.719	9.80	1,250
1912–13.						
October	1.75	.97	1.22	.508	.59	75.0
November	1.30	.61	.94	.392	.44	55.9
December	.73	.20	.47	.196	.23	28.9
January	.36	.16	.28	.117	.13	17.2
February	.32	.23	.28	.117	.12	15.6
March	.97	.20	.27	.112	.13	16.6
April	2.40	.27	1.13	.472	.53	67.2
May	3.22	.91	1.38	.575	.66	84.8
June	2.75	1.03	1.38	.575	.64	82.1
July	2.57	.61	1.44	.600	.69	88.5
August	3.31	1.75	2.10	.875	1.01	129
September	2.57	1.24	2.02	.842	.94	120
The year	3.31	.16	1.08	.450	6.11	781
1913–14.						
October	2.23	1.03	1.51	.629	.73	92.8
November	1.38	.61	.96	.400	.45	57.1
December	.85	.61	.74	.308	.36	45.5
January	.67	.51	.59	.246	.28	36.3
February	.56	.46	.50	.208	.22	27.8
March	.85	.51	.61	.254	.29	37.5
April	3.22	.73	1.99	.830	.93	118
May	7.38	2.93	5.12	2.13	2.46	315
June	9.37	4.52	6.51	2.71	3.02	387
July	10.1	4.31	6.81	2.84	3.27	419
August	6.68	2.93	4.60	1.92	2.21	283
September	2.67	1.63	2.05	.854	.95	122
The year	10.1	.46	2.68	1.17	15.17	1,940
1914–15.						
October	1.60	.97	1.34	.558	.64	82.4
November	1.30	.67	.96	.400	.45	57.1
December	.79	.41	.56	.233	.27	34.4
January	.85	.36	.47	.196	.23	28.9
February	.46	.41	.44	.184	.19	24.4
March	.56	.36	.43	.179	.21	26.4
April	3.90	.51	1.52	.634	.71	90.4
May	5.62	2.38	4.27	1.78	2.05	263
June	7.29	5.40	6.47	2.70	3.01	385
July	6.08	3.70	4.83	2.01	2.32	297
August	5.74	3.50	4.72	1.97	2.27	290
September	4.31	2.23	3.04	1.27	1.42	181
The year	7.29	.36	2.43	1.01	13.77	1,760
1915–16.						
October	2.10	1.24	1.65	.688	.79	101
November	1.17	.91	1.04	.434	.48	61.9
December	.91	.73	.80	.334	.39	49.2
January	.73	.56	.62	.258	.30	38.1
February	.61	.46	.55	.229	.25	31.6
March	.79	.46	.59	.246	.28	36.3
April	1.90	.61	1.02	.425	.47	60.7
May	3.06	1.63	2.56	1.07	1.23	157
June	2.49	.97	1.68	.700	.78	100
July	3.12	.85	1.16	.484	.56	71.3
August	4.21	2.10	2.87	1.20	1.38	176
September	2.84	1.52	2.09	.872	.97	124
The year	4.21	.46	1.40	.580	7.88	1,010

RED RIVER BASIN.

MEDICINE BLUFF CREEK NEAR LAWTON, OKLA.

Location.—In sec. 18, T. 3 N., R. 12 W., at Medicine Park, 12 miles northwest of Lawton, in Comanche County; nearest tributary, Little Medicine Bluff Creek, enters a few hundred yards above.

Drainage area.—Approximately 110 square miles.

Records available.—November 26, 1912, to September 30, 1916.

Gage.—Stevens water-stage recorder installed February 16, 1915, on left bank one-third mile below Medicine Park Hotel. Original gage was vertical staff on left bank a short distance below hotel, and set to datum 0.68 foot higher than that of the present gage; fall between the two points, 0.18 foot.

Discharge measurements.—Made from cable 100 yards above gage or by wading at control.

Channel and control.—Channel composed of sand and gravel overlying bedrock; control is rock ledge in the lowest part of which, for a width of 10 feet, are boulders; control practically permanent. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 5.1 feet October 15 (discharge, 985 second-feet); minimum stage, 1.33 feet at 12 noon September 28 (discharge, 0.4 second-foot).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—The Lawton waterworks diverts about 1.6 second-feet from Lawton reservoir on Medicine Bluff Creek.

Regulation.—Flow controlled to a great extent by Lawton reservoir, which is 1½ miles upstream; capacity, 14,000 acre-feet.

Natural run-off.—To show natural run-off of Medicine Bluff Creek by months, computations have been made which include flow past gage, daily loss from evaporation, gain or loss by storage, and diversion for Lawton waterworks.

Accuracy.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 1,500 second-feet. Operation of water-stage recorder satisfactory except for occasional short periods. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspection of gage-height graph. Results excellent for medium and high stages. For low stages the actual error is small, but the percentage error may be large.

Discharge measurements of Medicine Bluff Creek near Lawton, Okla., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 18	Robert Follansbee	2.03	11.1
Apr. 16	J. B. Lenerts	3.80	281
May 12	Robert Follansbee	1.62	3.4

Daily discharge, in second-feet, of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	34	23	16	10	55	13	24	43	21	20	13	6
2	24	22	11	11	14	24	21	13	23	19	13	71
3	23	21	11	10	26	11	16	19	21	19	13	13
4	64	20	11	11	32	3.2	18	8	20	20	13	11
5	18	19	11	12	60	1.4	25	12	17	26	12	11
6	11	18	11	11	34	.8	26	13	15	26	12	4.6
7	23	16	11	11	30	17	44	12	16	26	13	.9
8	12	33	11	11	23	3.2	36	17	16	26	12	4.8
9	11	20	11	11	33	2.2	24	13	16	27	12	6
10	11	12	16	11	22	6	21	32	16	27	12	6
11	11	19	13	14	29	14	19	8	16	28	14	8
12	13	12	11	33	113	12	17	3.2	17	28	15	6
13	12	11	10	12	64	12	19	3.6	17	24	16	7
14	12	64	10	11	55	64	101	8	18	31	15	7
15	175	12	10	14	45	13	495	24	18	34	16	6
16	648	13	13	18	35	12	282	12	18	11	15	6
17	373	31	9	8	25	12	160	15	18	16	13	6
18	350	18	9	13	15	12	126	16	18	13	10	6
19	300	12	9	7	10	13	98	16	18	15	11	6
20	250	11	9	8	3	12	92	16	18	14	12	6
21	150	22	9	8	2.2	15	47	15	18	13	12	3.4
22	100	10	10	8	10	17	47	15	18	12	12	3.2
23	55	10	10	8	18	15	56	15	18	12	12	9
24	56	11	19	8	7	15	44	15	18	12	12	18
25	58	15	10	8	6	16	34	15	77	12	12	3
26	60	11	10	71	17	24	60	15	63	12	12	2.1
27	50	14	23	200	4.8	17	27	15	49	12	12	1.5
28	41	14	10	116	24	20	16	15	35	12	12	.5
29	32	11	10	118	6	13	12	15	21	12	12	.9
30	24	11	10	73	....	14	32	15	20	12	10	.9
31	24	....	10	98	....	14	....	18	....	13	8	....

NOTE.—Discharge estimated Oct. 18–22, 24–25, 27, Nov. 1–6, Feb. 14–19, June 17, 19–24, 26–28.

Monthly discharge of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	648	11	97.6	6,000
November	64	10	17.9	1,070
December	23	9	11.4	701
January	200	7	31.1	1,910
February	113	2.2	28.2	1,620
March	64	.8	14.1	867
April	495	12	68.3	4,060
May	43	3.2	15.2	935
June	77	15	23.1	1,370
July	34	11	18.8	1,160
August	16	8	12.5	769
September	71	.5	8.03	494
The year	648	.5	28.9	21,000

Corrected monthly discharge of Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1916.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	103	6,330	May	24.4	1,500
November	19.4	1,150	June	23.3	1,390
December	10.6	652	July	21.6	1,330
January	40.9	2,510	August	8.0	492
February	36.7	2,110	September	9.1	541
March	11.5	707			
April	83.7	4,980	The year	32.7	23,700

NOTE.—Record corrected for storage, evaporation, and the diversion to Lawton reservoir.

LITTLE MEDICINE BLUFF CREEK NEAR LAWTON, OKLA.

LOCATION.—One hundred and fifty feet below west line of sec. 18, T. 3 N., R. 12 W., half a mile above the mouth of creek and 12½ miles northwest of Lawton, in Comanche County.

DRAINAGE AREA.—Approximately 10 square miles.

RECORDS AVAILABLE.—November 26, 1912, to September 30, 1916.

GAGE.—Vertical staff on left bank; read by J. B. Lenertz. Upstream 200 feet is a gage referred to same datum, which is read by observer during flood to determine slope between it and regular gage.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Channel composed of ledge rock overlaid with sand; control is rock ledge just below gage. Between station and crest of small dam on Medicine Bluff Creek just below Little Medicine Bluff Creek there is a fall of about 8 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.97 foot April 15 and September 2 (discharge, 41 second-feet). Stream dry most of July and August.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; not affected by ice. Rating curve well-defined below 200 second-feet. Gage read to quarter-tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Results considered only fair as a very slight error in actual discharge would be a large percentage error.

The following discharge measurement was made by Robert Follansbee:

May 11, 1916: Gage height, 0.18 foot; estimated discharge, 0.3 second-foot.

Daily discharge, in second-feet, of Little Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.
1	1.6	0.2	0.3	0.2	17	0.3	0.2	0.3	0.2	0.2	......	0.3
2	1.0	.2	.3	.2	10	.3	.3	.3	.2	.2	......	41
3	.6	.2	.3	.2	3.5	.2	.3	.6	.2	.1	......	6.2
4	.3	.2	.3	.2	1.6	.2	.3	.6	.2	.1	......	1.6
5	.3	.2	.3	.2	1.6	.2	6	.3	.2	.1	......	.2
6	.3	.2	.3	.2	1.6	.3	.6	.3	.2	.1	......	.2
7	.3	.2	.3	.2	1.6	.6	.6	.3	.2	.1	......	.3
8	.3	.2	.3	.2	1.0	.6	.6	.3	.1	.1	......	.2
9	.3	.2	.3	.3	1.0	.6	.6	.3	.1	.1	......	.2
10	.3	.2	.3	.3	.6	.6	.6	.3	.2	.1	......	.2
11	.3	.2	.3	.3	.6	.6	.6	.3	.2	......	......	.6
12	.3	.2	.2	.3	.6	.6	.6	.3	.2	......	......	1.0
13	.3	.2	.2	.3	.6	.6	2.5	.3	.2	......	......	.6
14	.3	.2	.2	.3	.3	.3	4.8	.3	.2	......	......	.3
15	4.8	.2	.2	.3	.3	.3	41	.3	.2	......	......	.2
16	3.5	.3	.2	.3	.3	.3	35	.3	.1	......	......	.2
17	3.5	.3	.2	.3	.3	.3	25	.3	.1	......	......	.2
18	1.6	.3	.2	.2	.3	.3	9.4	.6	.1	......	......	.2
19	1.0	.3	.2	.2	.6	.3	3.5	.6	.2	......	......	.2
20	1.0	.3	.2	.3	.6	.2	2.5	1.0	.2	.3	......	.2
21	1.0	.3	.2	.6	1.0	.2	1.6	1.0	.2	.2	......	.2
22	.6	.3	.2	.6	1.0	.2	1.0	.6	.2	.2	......	.2
23	.6	.3	.2	.6	1.0	.2	.6	.6	.2	.2	......	.2
24	.6	.3	.2	.6	1.0	.2	.3	.6	.2	.1	......	.2
25	.3	.3	.2	1.0	.6	.2	.3	.3	3.0	.1	......	.2
26	.3	.3	.2	.2	.6	.2	.3	.3	.6	......	......	.2
27	.2	.3	.2	.2	.6	.2	.2	.3	.3	......	......	.2
28	.2	.3	.2	.2	.6	.2	.2	.3	.3	......	......	.2
29	.2	.3	.2	.2	.6	.2	.2	.2	.2	......	......	.1
30	.2	.3	.2	.2	......	.2	.2	.2	.2	......	......	.1
31	.2	......	.2	25	......	.2	......	.2	......	......	0.3	......

NOTE.—Channel practically dry July 11-19, and July 26 to Aug. 30. Discharge interpolated Oct. 27.

Monthly discharge of Little Medicine Bluff Creek near Lawton, Okla., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4.8	0.2	0.85	52
November	.3	.2	.25	15
December	.3	.2	.24	15
January	25	.2	1.11	68
February	17	.3	1.74	100
March	.6	.2	.32	20
April	41	.2	4.48	267
May	.9	.2	.40	25
June	3.0	.1	.30	18
July	.3	.0	.07	4
August	.3	.0	.01	0
September	41	.1	1.86	111
The year	41	0	.96	695

EVAPORATION STATION NEAR LAWTON, OKLA.

Location.—In a somewhat sheltered bay on the west side of Lawton reservoir, 12 miles northwest of Lawton, in Comanche County.

Records available.—February 20, 1913, to September 30, 1916.

Equipment for measurement.—A galvanized iron pan, 3 feet square and 18 inches deep, floating in the center of a skeleton raft about 75 feet from the shore; in the center of the pan is a vertical needle point which is the reference point for measuring evaporation. New needle installed May 4, 1916, with point 3 inches below top of pan. Old point was 7 inches below top. Rainfall measured by rain gage on raft.

Daily evaporation, in inches, at Lawton reservoir, near Lawton, Okla., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.31	0.19	0.12	0.04	0.02	0.03	0.00	0.12	0.47	0.29	0.37	0.06
2	.29	.20	.07	.05	.02	.02	.06	.10	.46	.32	.36	.23
3	.30	.19	.13	.05	.02	.04	.07	.14	.49	.33	.38	.41
4	.27	.21	.14	.05	.02	.04	.08	.17	.17	.37	.37	.34
5	.30	.20	.16	.03	.02	.06	.06	.20	.31	.33	.39	.33
6	.27	.18	.00	.00	.02	.05	.07	.19	.33	.30	.37	.31
7	.23	.22	.06	.00	.02	.06	.07	.21	.01	.31	.35	.12
8	.24	.19	.09	.00	a.03	.06	.05	.28	.44	.30	.36	.29
9	.23	.21	.10	.03	.04	.05	.06	.47	.47	.32	.38	.32
10	.23	.18	.08	.03	.03	.07	.10	.49	.47	.37	.37	.33
11	.27	.20	.06	.04	.04	.06	.13	.51	.48	.34	.39	.07
12	.32	.21	.07	.03	.02	.06	.10	.19	.37	.33	.38	.08
13	.26	.18	.07	.03	.03	.07	.10	.27	.36	.33	.38	.29
14	.26	.17	.08	.03	.03	.05	.09	.23	.40	.36	.37	.28
15	.23	.14	.00	.03	.04	.06	.03	.31	.40	.37	.39	.31
16	.21	.16	.06	.03	.04	.07	.08	.37	.40	.37	.36	.29
17	.25	.17	.07	.03	.03	.08	.06	.29	.39	.34	.38	.30
18	.27	.19	.05	.03	.02	.08	.08	.07	.41	.34	.37	.29
19	.28	.22	.08	.02	.04	.09	.09	.30	.46	.19	.35	.28
20	.26	.20	.07	.02	.04	.10	.08	.07	.48	.32	.37	.30
21	.24	.16	.06	.02	.03	.09	.11	.38	.47	.30	.37	.27
22	.27	.18	.00	.02	.03	.07	.12	.37	.49	.33	.38	.24
23	.23	.19	.08	.02	.02	a.08	.12	.47	.50	.34	.37	.23
24	.23	.17	.03	.02	.04	.09	.11	.40	.46	.33	.35	.20
25	.24	.14	.06	.02	.05	.04	.13	.38	.35	.36	.36	.19
26	.21	.17	.03	.02	.04	.04	.12	.33	.41	.37	.38	.21
27	.19	.13	.02	.02	.02	.07	.14	.41	.39	.34	.34	.18
28	.20	.12	a.02	.02	.02	.08	.15	.40	.38	.36	.35	.15
29	.20	.14	a.02	.02	.03	.07	.14	.43	.31	.37	.37	.14
30	.19	.13	.03	.02	......	.06	.04	.50	.30	.36	.36	.16
31	.18	......	.00	.02	......	.00	......	.43	......	.35	.10	......

a Estimated.

Note.—Reservoir frozen over Jan. 1 to Feb. 5, and evaporation estimated.

Monthly evaporation, in inches, at Lawton reservoir, near Lawton, Okla., for the year ending Sept. 30, 1916.

October	7.66	March	1.88	August	11.17
November	5.34	April	2.64	September	7.20
December	1.90	May	9.48		
January	.79	June	11.83	The year	71.17
February	.85	July	10.34		

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  Tennessee Fork near........ 17–18
Little Medicine Bluff Creek near Lawton, Okla........ 45–46
Lion Creek near Halfway, Colo........ 32–34

M.

McReynolds, B. B., cooperation of........ 11
Medicine Bluff Creek near Lawton, Okla........ 43–45
  Little, near Lawton, Okla........ 45–46
Miner's inch, definition of........ 6
  equivalents of........ 8

P.

Pikes Peak, Colo., Boehmer Creek near........ 27–29
  Little Beaver Creek near........ 29–31
  Sackett Creek near........ 31–32
Poncha, Colo., South Fork of Arkansas River at........ 23–24
Poncha Creek at Poncha, Colo........ 24–26
Point of zero flow, definition of........ 7

R.

Reclamation Service, cooperation of........ 11
Red River basin, Okla., stream flow in........ 43–47
Run-off, definition of........ 6
Ruxton Creek, South, at Halfway, Colo........ 37–40

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Sackett Creek near Pikes Peak, Colo........ 31–32
St. Elmo, Colo., Chalk Creek near........ 22–23
  upper station on Chalk Creek, near........ 20–21
Salida, Colo., Arkansas River at........ 15–17
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Sheep Creek near Halfway, Colo........ 35–37
Smith, H. K., work of........ 12

T.

Tennessee Fork near Leadville, Colo........ 17–18

V.

Victor, Colo., West Beaver Creek at........ 26

W.

Water power, calculation of........ 9
Water-stage recorders, views of........ 11
Watkins, T. J., work of........ 12
West Beaver Creek near Victor, Colo........ 26
Work, division of........ 12

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART VII. LOWER MISSISSIPPI RIVER BASIN

I

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, annual reports, and monographs.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features, as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins (in three parts).

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, Kapiolani Building.
Topeka, Kansas, 25 Federal Building.

A list of the Geological Survey's publications may be obtained by applying to the Director, United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,800 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A = Annual Report; B = Bulletin; W = Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 to 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1916. The data for any particular station will, in general, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1916, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1916.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
	North Atlantic slope (St. John River to York River).	South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	Ohio River.	St. Lawrence River and Great Lakes.	Hudson Bay and upper Mississippi River.	Missouri River.	Lower Mississippi River.	Western Gulf of Mexico.	Colorado River.	Great Basin.	Pacific slope in California.	North Pacific slope basins.		
												Pacific slope in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope in Oregon.
1899 [a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 78	66, 75
1902	82	[b] 82, 83	83	[b] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[h] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Estimates for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Gallatin River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific slope basins.

[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Estimates for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Scioto River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page III, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

PART VII. LOWER MISSISSIPPI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams flowing to the Mississippi below the mouth of the Missouri on the west and the Ohio on the east, are Meramec, White, Arkansas (whose chief tributaries are Huerfano, Purgatory, Cimarron, Verdigris, Neosho, and Canadian rivers), Yazoo, Homochitto, and Red rivers. The streams drain wholly or in part the States of Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. XX–XXV.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1916; period after a date indicates discontinuance.

MERAMEC RIVER BASIN.

Meramec River near Meramec, Mo., 1903–1906.
Meramec River near Eureka, Mo., 1903–1906.
Meramec River (Station No. 1) at Fenton, Mo., 1903.
Meramec River (Station No. 2) below Fenton, Mo., 1903.
    Dry Fork of Meramec River near St. James, Mo., 1903.
    Spring Branch:
        Meramec Spring near Meramec, Mo., 1903–1906.
    Courtois Creek at Scotia, Mo., 1905–6.

WHITE RIVER BASIN.

White River at Beaver, Ark., 1909–10.
White River near Branson, Mo., 1909–10.
White River near Lead Hill, Ark., 1909–10.
White River near Cotter, Ark., 1909–10.
    Buffalo River near Gilbert, Ark., 1909–10.
    North Fork River near Henderson, Ark., 1909–10.
    Black River:
        Eleven Point River:
            Greer Spring at Greer, Mo., 1904.
    Little Red River near Pangburn, Ark., 1909–10.

ARKANSAS RIVER BASIN.

Arkansas River, East Fork (head of Arkansas River), near Leadville, Colo., 1890; 1911–
Arkansas River at Granite, Colo., 1897–1899; 1910–
Arkansas River at Salida, Colo., 1895–1903; 1909–

Arkansas River at Canon City, Colo., 1888–1913.
Arkansas River near Rock Canyon, Colo., 1889.
Arkansas River at Pueblo, Colo., 1885–1889; 1894–1913.
Arkansas River near Nepesta, Colo., 1897–1903; 1909–1913.
Arkansas River near Manzanola, Colo., 1898.
Arkansas River near Rocky Ford, Colo., 1897–1903.
Arkansas River at La Junta, Colo., 1889; 1894–95; 1901; 1903; 1906; 1912–13.
Arkansas River at Las Animas, Colo., 1898; 1909.
Arkansas River at New Fort Lyons, Colo., 1911.
Arkansas River near Prowers, Colo., 1903.
Arkansas River at Prowers, Colo., 1900–1901.
Arkansas River near Amity canal head gates, Colo., 1898–99; 1901.
Arkansas River near Lamar, Colo., 1913.
Arkansas River near Granada, Colo., 1898–1901; 1903.
Arkansas River near Holly (Barton or Byron), Colo., 1894; 1901–2; 1907–1913.
Arkansas River near Coolidge, Kans., 1903.
Arkansas River near Syracuse, Kans., 1902–1906.
Arkansas River at Dodge, Kans., 1903–1906.
Arkansas River near Hutchinson, Kans., 1895–1905.
Arkansas River at Arkansas City, Kans., 1902–1906.
  Tennessee Fork near Leadville, Colo., 1890; 1903; 1911–
  Lake Fork of Arkansas River near Arkansas Junction, Colo., 1890; 1903.
  Half Moon Creek near Leadville, Colo., 1911–1914.
  Lake Creek near Twin Lakes, Colo., 1899–1900.
  Twin Lakes outlet near Twin Lakes, Colo., 1910.
  Clear Creek near Granite, Colo., 1890; 1910.
  Cottonwood Creek near Buena Vista, Colo., 1890.
  Cottonwood Creek at Hot Springs tunnel, near Buena Vista, Colo., 1910–11.
  Cottonwood Creek below Hot Springs, near Buena Vista, Colo., 1911–
    South Fork of Cottonwood Creek near Buena Vista, Colo., 1890.
    North Cottonwood Creek near Buena Vista, Colo., 1911–1914.
  Chalk Creek (upper station) near St. Elmo, Colo., 1913–
  Chalk Creek near St. Elmo, Colo., 1911–1916.
  Chalk Creek near Buena Vista, Colo., 1910.
  South Fork of Arkansas River at Poncha, Colo., 1911–
    Poncha Creek at Poncha, Colo., 1911–
  Grape Creek near Canon City, Colo., 1907–1909.
  Oil or Fourmile Creek near Canon City, Colo., 1910.
  West Beaver Creek (head of Beaver Creek) near Victor, Colo., 1905–
  Boehmer Creek near Pikes Peak, Colo., 1909–
  Little Beaver Creek near Pikes Peak, Colo., 1909–
  Sackett Creek near Pikes Peak, Colo.,1909–
  Lion Creek near Halfway, Colo., 1908–
  Sheep Creek near Halfway, Colo., 1908–
  South Ruxton Creek near Halfway, Colo., 1906–
  Cabin Creek near Halfway, Colo., 1906–
  Huerfano River at Badito, Colo., 1912.
  Huerfano River near Undercliffe, Colo., 1908.
  Cucharas River at Walsenburg, Colo., 1907–8.
  Purgatory (Las Animas) River at Trinidad, Colo., 1896–1899; 1905–1912.
  Purgatory River near canyon entrance (Alfalfa), Colo., 1905–1907.
  Purgatory River at J. J. ranch near La Junta, Colo., 1898.
  Purgatory River near Las Animas, Colo., 1889 and 1909.
  Big Sandy Creek at Hugo, Colo., 1910–1912.

Arkansas River tributaries—Continued.
- Big Sandy Creek near Kit Carson, Colo., 1910–1912.
  - Big Spring Creek near Arena, Colo., 1910–1912.
- Walnut River near Arkansas City, Kans., 1902–3.
- Salt Fork of Arkansas River near Alva, Okla., 1904–5.
- Salt Fork of Arkansas River near Tonkawa, Okla., 1903–1905.
  - Medicine Lodge River near Kiowa, Kans., 1895–96.
- Cimarron River near Arkalon, Kans., 1895–96; 1903–1905.
- Cimarron River near Kenton, Okla., 1904–5.
- Cimarron River near Garrett, Okla., 1905–1907.
- Cimarron River near Waynoka, Okla., 1903–1905.
- Verdigris River near Independence, Kans., 1904.
- Verdigris River near Liberty, Kans., 1895–1903.
- Verdigris River near Catoosa, Okla., 1903–1905.
  - Fall River at Fall River, Kans., 1904–5.
- Neosho River near Neosho Rapids, Kans., 1904.
- Neosho River near Iola, Kans., 1895–1903.
- Neosho River near Humboldt, Kans., 1904.
- Neosho River (or Grand River) near Fort Gibson, Okla., 1899; 1903–1905.
- Canadian River near Sanchez, N. Mex., 1912–1914.
- Canadian River at Logan, N. Mex., 1904–05; 1908–1914.
- Canadian River at Calvin, Okla., 1905–1908.
  - Chicorica Creek near Raton, N. Mex., 1910–1914.
    - Una del Gato Creek near Raton, N. Mex., 1910–1913.
  - Cimarron River at Ute Park, N. Mex., 1907–1914.
  - Cimarron River at Springer, N. Mex., 1907–1909.
    - Rayado River near Cimarron, N. Mex., 1911; 1913; 1914.
    - Rayado River above Abreu's ranch, near Cimarron, N. Mex., 1911–1914.
    - Rayado River at Abreu's ranch, near Cimarron, N. Mex., 1908–9.
    - Rayado River below Abreu's ranch, near Cimarron, N. Mex., 1912–13.
    - Rayado River near Springer, N. Mex., 1907–1909.
      - Urraca Creek near Cimarron, N. Mex., 1912–1914.
  - East Fork of Ocate River at Ocate, N. Mex., 1914.
  - Ocate River at Ocate, N. Mex., 1914.
    - West Fork of Ocate River at Ocate, N. Mex., 1914.
    - Sweetwater Creek near Colmar, N. Mex., 1914.
  - Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1911.
  - Mora River near Weber, N. Mex., 1903–4.
  - Mora River near Watrous, N. Mex., 1894–1896.
  - Mora River near Shoemaker, N. Mex., 1914.
    - Sapello River at Sapello, N. Mex., 1903–4.
    - Sapello Mill tailrace at Sapello, N. Mex., 1903–4.
    - Sapello River at Los Alamos, N. Mex., 1903–1911.
      - Manuelitos River near Sapello, N. Mex., 1903–4.
  - Pajarito Creek near Hanley, N. Mex., 1911–1913.
  - Pajarito Creek below Vigil Creek, near Hanley, N. Mex., 1912–13.
  - Ute Creek near Logan, N. Mex., 1904–1906; 1909–1914.
  - Beaver Creek (head of North Fork of Canadian River) at Beaver, Okla., 1904–5.
  - North Fork of Canadian River near Woodward, Okla., 1903–1906.
  - North Fork of Canadian River near El Reno, Okla., 1902–1908.
  - North Fork of Canadian River near Oklahoma, Okla., 1899.
  - North Fork of Canadian River near Eufaula, Okla., 1899.

ARKANSAS RIVER CANALS.

Oxford Farmers canal near Nepesta, Colo., 1902-3.
Colorado-Kansas canal near Prowers, Colo., 1903.
Keese ditch near Prowers, Colo., 1903.

YAZOO RIVER BASIN.

Tallahatchie River (head of Yazoo River) at Batesville, Miss., 1906-1912
Tallahatchie River at Phillip, Miss., 1908-1913.
Yazoo River at Greenwood, Miss., 1908-1913.
Yazoo River at Yazoo City, Miss., 1900-1905.
    Coldwater River at Savage, Miss., 1908-1912.
    Yalobusha River at Grenada, Miss., 1906; 1908-1912
    Sunflower River near Ruleville, Miss., 1909-1912.
    Sunflower River at Baird, Miss., 1908-1912.

HOMOCHITTO RIVER BASIN.

Homochitto River at Rosetta, Miss., 1906.

RED RIVER BASIN.

Red River at Arthur City, Tex., 1905-1911.
    Salt Fork of Red River at Mangum, Okla., 1905-6.
        Turkey Creek [Deep Red Run] at Olustee, Okla., 1905-1908.
    North Fork of Red River near Granite, Okla., 1903-1908.
    North Fork of Red River near Snyder, Okla., 1905.
    North Fork of Red River near Headrick, Okla., 1905-1908.
        Elm Fork of Red River near Mangum, Okla., 1905-1908.
        Elk Creek near Hobart, Okla., 1904-1908.
        Otter Creek near Mountain Park, Okla., 1903-1908.
            Horse Creek near Mountain Park., Okla., 1905-6.
            Dry Fork of Otter Creek near Mountain Park., Okla., 1905-6.
    Cache Creek:
        Medicine Bluff Creek near Lawton, Okla., 1912-
            Little Medicine Bluff Creek near Lawton, Okla., 1912-
    Evaporation station near Lawton, Okla., 1913-
    Wichita River at Wichita Falls, Tex., 1910-11.
    Washita River at Anadarko, Okla., 1902-1908.
    Washita River near Pauls Valley, Okla., 1899.
    Ouachita River near Malvern, Ark., 1903-1905.
    Ouachita River near Arkadelphia, Ark., 1905-6.

REPORTS ON WATER RESOURCES OF THE LOWER MISSISSIPPI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls. 10c.

Describes reservoirs for storm and pumped waters, ditching, methods of distributing water, cultivation and subirrigation, duty of water, and winter irrigation.

*6. Underground waters of southwestern Kansas, by Erasmus Haworth. 1897. 65 pp., 12 pls. 15c.

Describes physiography, drainage, geologic formations and water supply, and irrigation development in Meade, Dodge, and Garden quadrangles, including all of Meade County, nearly all of Seward, Haskell, and Gray counties, about one-third of Ford County, and one-fourth of Finney County; discusses waters of Dakota sandstone and of the Tertiary formations.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes the location and construction of various types of canals for irrigation.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River divisions, drainage and irrigation, and gives records of stream flow.

*96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp. 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

101. Underground waters of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping, and treats briefly of rice cultivation.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on springs and wells of Arkansas and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams, including Red and Canadian rivers.

*107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Appendix contains gage heights, rating tables, estimates of monthly discharge of Yazoo River.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains a "Summary of the water supply of the Ozark region in northern Arkansas, by George I. Adams"; describes the drainage and some of the immense springs of the area, many of which have been developed as resorts.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:
Mississippi, by L. C. Johnson.
Louisiana and southern Arkansas, by A. C. Veatch.
Northern Arkansas, by A. H. Purdue.
Each of these reports discusses the geologic formation as related to water supply, treats particularly of the mineral waters, and gives a list of the principal publications.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains five short reports relating to areas draining to the lower Mississippi River:

Water resources of the Joplin district, Missouri-Kansas, by W. S. Tangier Smith. Describes topography, geology, streams, springs, and wells; gives analyses of waters.

Water resources of the Winslow quadrangle, Arkansas, by A. H. Purdue. Area includes a few square miles of Oklahoma, discusses water-bearing formation and the quality of spring and well waters.

Notes on certain hot springs of the southern United States, by Walter Harvey Weed. Gives an account of the history, topography, geology, flow, temperature, and composition of the Hot Springs of Arkansas, including many analyses.

Notes on certain large springs of the Ozark region, Missouri and Arkansas, compiled by Myron L. Fuller. Treats briefly of the conditions under which the springs emerge, and of their flow, temperature, and quality.

Water resources of the contact region between the Paleozoic and Mississippi embayment deposits in northern Arkansas, by A. H. Purdue. Describes geology and water resources of a belt 12 to 15 miles wide extending along the western edge of the Mississippi embayment deposits from Arkansas River northward to the Missouri line. Considers source of water, amount, chemical character and use of water, prospects for flowing wells, etc.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Describes floods on Kansas, Neosho, Verdigris, Osage, Arkansas, Canadian, and Purgatory rivers, discussing the streams, precipitation, damages, prevention of future damages, etc.

*148. Geology and water resources of Oklahoma, by C. N. Gould. 1905. 178 pp., 22 pls. 20c.

Describes topography, geology, climate, streams, springs, deep wells (water and oil and gas), and artesian water, and discusses the water supply by counties; treats of irrigation from reservoirs, springs, and wells; gives analyses of well waters and table of well records.

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height, of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*153. The underflow in Arkansas Valley in western Kansas, by C. S. Slichter. 1906. 90 pp., 3 pls. 15c.

Discusses origin and extent of the underflow, fluctuations of ground-water level, the chemical composition of the waters (including analyses); gives results of measurements at various points and summaries and details of pumping tests.

*154. The geology and water resources of the eastern portion of the Panhandle of Texas, by C. N. Gould. 1906. 64 pp., 15 pls. 10c.

Discusses topography, geology, streams, springs, ground waters, and irrigation; gives details by counties.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 86 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters, artesian requisites, and special conditions in the Coastal Plain formations; gives notes on wells, by counties, deep-well records, and selected records in detail; treats of sanitary aspect of wells and gives analyses.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Contains brief report entitled "Drainage of wet lands in Arkansas by wells," by A. F. Crider.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives account of flood on Purgatory River, Colorado, and estimates of flood flow and discharge of Arkansas River at Pueblo, Colo.; contains also index to literature on flood flow in American streams.

*164. Underground waters of Tennessee and Kentucky west of Tennessee River and of an adjacent area in Illinois, by L. C. Glenn. 1906. 173 pp., 7 pls. 25c.

Describes physical features, static level, and uses of waters, artesian conditions, and source properties of underground water; discusses topography, geology, and water resources by counties; gives logs of wells, analyses of waters, bibliography of most important reports.

*191. The geology and water resources of the western portion of the Panhandle of Texas, by C. N. Gould. 1907. 70 pp., 7 pls. 15c.

Describes the topography and general geology of the area, the deep-seated waters, springs, and streams, and the use of the waters for irrigation; discusses details of topography, geology, and water supply by counties.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of water, and many well records.

236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Mississippi, Arkansas, and Red rivers.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from Sapello River, Salt, North, and Elm forks of Red River, and Turkey Creek.

276. Geology and underground waters of northeastern Texas, by C. H. Gordon. 1911. 78 pp., 2 pls. 10c.

Describes geography, physiography, and geology of area comprising Bowie, Red River, Lamar, Delta, Hopkins, Franklin, Titus, Morris, Camp, and Cass counties; discusses the source and availability of underground waters, artesian waters of the various formations, and reviews the geographic relations, geology, and water resources by counties.

317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls. 10c.

Describes the physiography, climate, surface and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

(*a*) Preliminary report on ground water for irrigation in the vicinity of Wichita, Kans., by O. E. Meinzer, pp. 1-9.

(*b*) Ground water for irrigation in the vicinity of Enid, Okla., by A. T. Schwennesen, pp. 11-23, Pl. 1.

(*d*) Ground water for irrigation in the valley of North Fork of Canadian River near Oklahoma City, Okla., by A. T. Schwennesen, pp. 41-51.

399. Geology and ground waters of northeastern Arkansas, by L. W. Stephenson and A. F. Crider, with a discussion of the chemical character of the waters by R. B. Dole. 1916. 315 pp., 11 pls. 35c.

Describes the physiography of Arkansas, the character and distribution of the geologic formations, the streams, lakes, ponds, and swamps, the source, disposal, quantity, and distribution of the ground waters and their economic uses; gives details by counties; discusses, under chemical character of the waters, standards of classification, methods of purification, and the quality of surface and ground water; contains bibliography and gives many geologic sections and analyses of waters.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888-89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889-90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp., 30 pls. and maps. $1.25. Contains:

*Hydrography, pp. 1-110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111-200. Gives an account of the surveys in the Arkansas division.

*The arid lands, pp. 201-289. Includes a report on artesian irrigation on the Great Plains, a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291-343. Comprises reports of the topographic surveys in Colorado and New Mexico, and on reservoir sites.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp., 93 pls. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ended June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. 54–57. Describes reservoir sites in Chaffee, Custer, Fremont, Park, El Paso, Pueblo, Huerfano, Las Animas, Bent, Otero, Baca, Kiowa, and Lake counties, Colo.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow, classifies the drainage basins, and describes the rivers of the Arkansas River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Engineering results of irrigation survey by H. M. Wilson, pp. 351–427, Pls. 147–182. Describes work at Twin Lakes reservoir and Twin Lakes dam, Colorado.

*Report upon the construction of topographic maps and the selection and survey of reservoi. sites in the hydrographic basin of Arkansas River, Colo., by A. H. Thompson, pp. 429–444.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. 35–39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. $2.35. Contains:

The underground water of the Arkansas Valley in eastern Colorado, by G. K. Gilbert, pp. 551–601, Pls. 56–68. Describes the geology and topography of the district, the general conditions under which artesian water occurs, the gathering grounds, capacity, distribution, and quality of the water of the Dakota sandstone, the water of the upland sands, the terraces, and the dune sands, and the underflow of rivers and creeks.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, 768 pp., 156 pls. $2.35. Contains:

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. 113–156. Describes the area situated in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of tle High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, Pls. 51–65. ($2.20.)

*Pt. VII, Texas, 666 pp., 71 pls. $1.90 Consists of:

Geography and geology of the Black and Grand prairies, Texas, with detailed descriptions of the Cretaceous formations and special reference to artesian waters, by Robert T. Hill. Describes an area in Texas and southern Indian Territory [Oklahoma], comprising about 50,000 square miles; describes relief, drainage, and soils; gives a résumé of principles governing underground water; describes the artesian well systems of Texas and gives details of artesian conditions in Black and Grand prairies by counties; treats briefly of the chemical qualities of the artesian waters and gives analyses.

Twenty-second Annual Report of the United States Geological Survey, 1900-1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. *Pt. IV, Hydrography, 690 pp., 65 pls. Contains:

*The High Plains and their utilization (conclusion of paper in Twenty-first Ann. Rept., pt. 4), by W. D. Johnson, pp. 631-669, Pls. 51-65.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Arkansas, Colorado, New Mexico, Oklahoma, Kansas, Missouri, Tennessee, and Texas, and detailed records of wells in Otero County, Colo.; Greenwood, Montgomery, and Neosho counties, Kans., and St. Louis County, Mo. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas; and detailed records of wells in Hempstead County, Ark.; Fremont and Pueblo counties, Colo.; Allen, Chase, Coffey, and McPherson counties, Kans.; Panola County, Miss.; Nowata, Washington, Tulsa, Murray, Okmulgee, and Pawnee counties, Okla., and Clay and Roberts counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (* indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*32. Preliminary report on the geology and underground-water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes altitudes and slopes, climate, drainage, stratigraphic structure, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota, Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*46. Geology and underground-water resources of northern Louisiana and southern Arkansas, by A. C. Veatch. 1906. 422 pp., 51 pls. $1.50.

Describes the historical geology and topographic development of a portion of the Coastal Plain; discusses the fundamental principles governing underground waters and their application to this region; contains account of methods and costs of well making, gives well predictions and a short discussion of the underground conditions in each county, and data in regard to wells arranged in tables by counties, followed by notes giving sections, analyses of waters, etc.; contains also a dictionary of altitudes, arranged by counties.

*52. Geology and underground waters of the Arkansas Valley in eastern Colorado, by N. H. Darton. 1906. 90 pp., 28 pls.

Describes the stratigraphic, structural, and historical geology of the Arkansas Valley and the relation of the geologic formations to the underground waters; discusses the source, depths, areas of flow, head, quantity, and quality of the waters of the "Dakota" sandstone, and the waters of the "Red Beds" and Morrison formations, the Laramie and associated formations, the later Tertiary deposits, and the dune sands. "An extension of the preliminary examination of the region by G. K. Gilbert in 1894 and 1895." See Seventeenth Annual Report, part 2, 1896, pp. 551-601.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed, they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octave edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 or more at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

36. Pueblo, Colorado. 5c.

Describes the relations of geologic formations to underground waters.

*58. Elmoro, Colorado. 5c.

Discusses artesian water of the Dakota formation.

68. Walsenburg, Colorado. 5c.

Describes artesian waters.

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[1] Index maps showing areas in the lower Mississippi River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

*71. Spanish Peaks, Colorado. 5c.

Describes artesian waters of the area.

122. Tahlequah, Oklahoma-Arkansas. 5c.

Gives a brief account of the springs and underground waters.

*132. Muskogee, Oklahoma. 5c.

Discusses springs, wells, and surface waters.

*135. Nepesta, Colorado. 5c.

Discusses the source, head, and chemical properties of the artesian waters, gives records of deep borings, and treats briefly on irrigation by ditches from Arkansas River; gives analyses of water from wells at Pueblo and from a spring at Fowler.

148. Joplin district, Missouri-Kansas. (Reprinted in 1914.) 50c.

Discusses the water power of Spring River, Shoal Creek, and Center Creek, the municipal water supplies of Carthage, Webb City, Joplin, and Galena, and the dug wells and springs of the country districts, and artesian wells.

186. Apishapa, Colorado.[1]

Mentions briefly the development of irrigation in the quadrangle; discusses water-bearing beds, artesian head, and the most favorable places for borings for artesian waters.

198. Castle Rock, Colorado. 25c.

Describes storage of water near the head of Monument Creek (tributary to Arkansas River) and treats briefly of the underground waters.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the lower Mississippi River drainage basin are the reports of the State geologists of Kansas, Tennessee, Louisiana, and Texas, the Mississippi Agricultural Experiment Station, the Chief of Engineers, United States Army, the Mississippi River Commission, and the Tenth Census, volume 17. The following reports deserve special mention:

Special report on well waters in Kansas, by Erasmus Haworth, State geologist: Kansas Univ. Geol. Survey Bull. 1, 1913.

Report of the Board of irrigation survey and experiment for 1895 and 1896 to the Legislature of Kansas, 1897.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others: Louisiana Geol. Survey Bull. 1, 1905.

Geology and underground water resources of northern Louisiana, with notes on adjoining districts, by A. C. Veatch: Louisiana Geol. Survey Bull. 4, 1906.

Report on water purification investigation and on plans proposed for sewerage waterworks systems: New Orleans Sewerage and Water Board, 1903.

Water powers of Arkansas: A preliminary report on White River and some of its tributaries, by W. N. Gladson. 1911.

Preliminary report upon the drainage of lands overflowed by the North and Middle forks of Forked Deer River and Rutherford Fork of Obion River in Gibson County,

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[1] Issued in two editions—library (18 by 22 inches), 5c. and octavo (6 by 9 inches), 50c. Specify edition desired.

Tenn., by A. E. Morgan and S. H. McCrory: Tennessee Geol. Survey Bull. 3–B, 1910.

The delta of the Mississippi: the physics of the river, the control of its floods, and the redemption of the alluvion, by Col. Caleb G. Forshey, Cambridge, 1873.

Report upon the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbot: Prof. Papers Corps Top. Eng. U. S. Army, No. 4, 1861.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood, 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill: its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 15c.

*42. The windmill: its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. See also Nos. 64, 94, and 95.

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurement of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing steam flow and compares results derived from different instruments and methods. See also No. 94.

103. A review of the laws forbidding polultion of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.
The California or "stovepipe" method of well construction, by Charles S. Slichter.
Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.
Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.
Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

146. Proceedings of second conference of engineers of the Reclamation Service—Con.

Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

*150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground-water developments, and to indeterminate causes.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists of publications relating to underground waters, and contains the following brief reports of general interest:
Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of flourescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage, a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago, by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States, Part I. Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and cost of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c.

(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65.

364. **Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist.** 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. **Equipment for current-meter gaging stations, by G. J. Lyon.** 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

*375. **Contributions to the hydrology of the United States, 1915.** N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls.

(c) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77–84.

(e) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117–130.

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131–139.

Three papers presented at the conference of engineers of the water-resources branch in December, 1914.

400. **Contributions to the hydrology of the United States, 1916.** N. C. Grover, chief hydraulic engineer.

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.

(c) The measurement of silt-laden streams, by Raymond C. Pierce, pp. 39–51.

(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53–59.

416. **The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis.** 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continually being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, Pl. 21. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2 Contains:

*Irrigation in India, by H. M. Wilson, pp. 363–561, Pls. 107–146. See Water-Supply Paper 87.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, Pls. 111–146. Discusses the economical aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W J McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, Pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses;

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate cases for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, Pls. 6–16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous media, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, Pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate, population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream's slope and discharge and to the degree of comminution of the débris."

A highly technical report.

105. Hydraulic mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller, 1908. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

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[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

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DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 438

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART VIII. WESTERN GULF OF MEXICO BASINS

NATHAN C. GROVER, Chief Hydraulic Engineer
GLENN A. GRAY and ROBERT FOLLANSBEE, District Engineers

Prepared in cooperation with the
STATE OF TEXAS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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SURFACE WATER SUPPLY OF WESTERN GULF OF MEXICO BASINS, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid west. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1917.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 12.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In

connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miners' inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth of inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, acre-feet, and millions of cubic feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 7 to 9).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1..........	0.03719	1.041	1.079	1.116	1.153
2..........	.07438	2.083	2.157	2.231	2.306
3..........	.11157	3.124	3.236	3.347	3.459
4..........	.14876	4.165	4.314	4.463	4.612
5..........	.18595	5.207	5.393	5.578	5.764
6..........	.22314	6.248	6.471	6.694	6.917
7..........	.26033	7.289	7.550	7.810	8.070
8..........	.29752	8.331	8.628	8.926	9.223
9..........	.33471	9.372	9.707	10.041	10.376

Note.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge. (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1..........	1.983	55.54	57.52	59.50	61.49
2..........	3.967	111.1	115.0	119.0	123.0
3..........	5.950	166.6	172.6	178.5	184.5
4..........	7.934	222.1	230.1	238.0	246.0
5..........	9.917	277.7	287.6	297.5	307.4
6..........	11.90	333.2	345.1	357.0	368.9
7..........	13.88	388.8	402.6	416.5	430.4
8..........	15.87	444.3	460.2	476.0	491.9
9..........	17.85	499.8	517.7	535.5	553.4

Note.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge. (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1..........	0.0864	2.419	2.506	2.592	2.678
2..........	.1728	4.838	5.012	5.184	5.356
3..........	.2592	7.257	7.518	7.776	8.034
4..........	.3456	9.676	10.02	10.37	10.71
5..........	.4320	12.10	12.53	12.96	13.39
6..........	.5184	14.51	15.04	15.55	16.07
7..........	.6048	16.93	17.54	18.14	18.75
8..........	.6912	19.35	20.05	20.74	21.42
9..........	.7776	21.77	22.55	23.33	24.10

Note.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	5	7	8	9
0	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3	3.41	3.52	3.64	3.75	[illegible]	3.98	4.09	4.20	4.32	4.43
4	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13.752 inches deep.

1 second-foot for one year (365 days) equals 31,536.000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-feet.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1¼ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

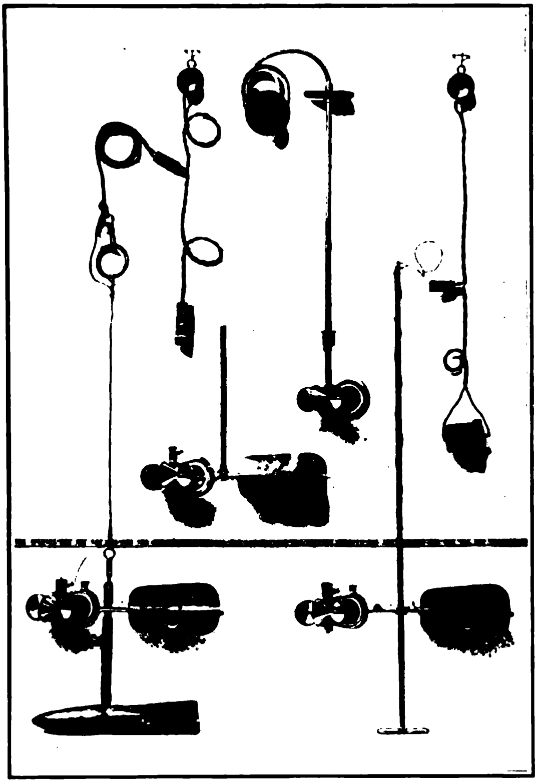
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

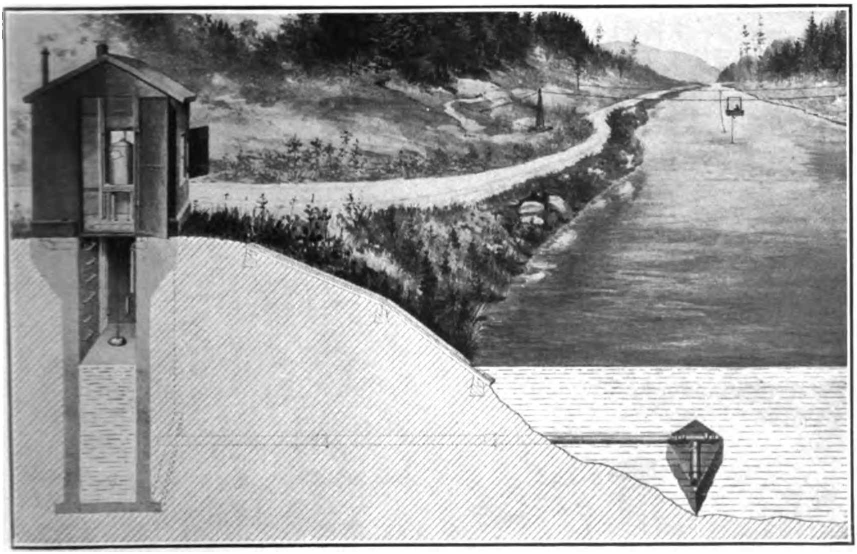
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum amd minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

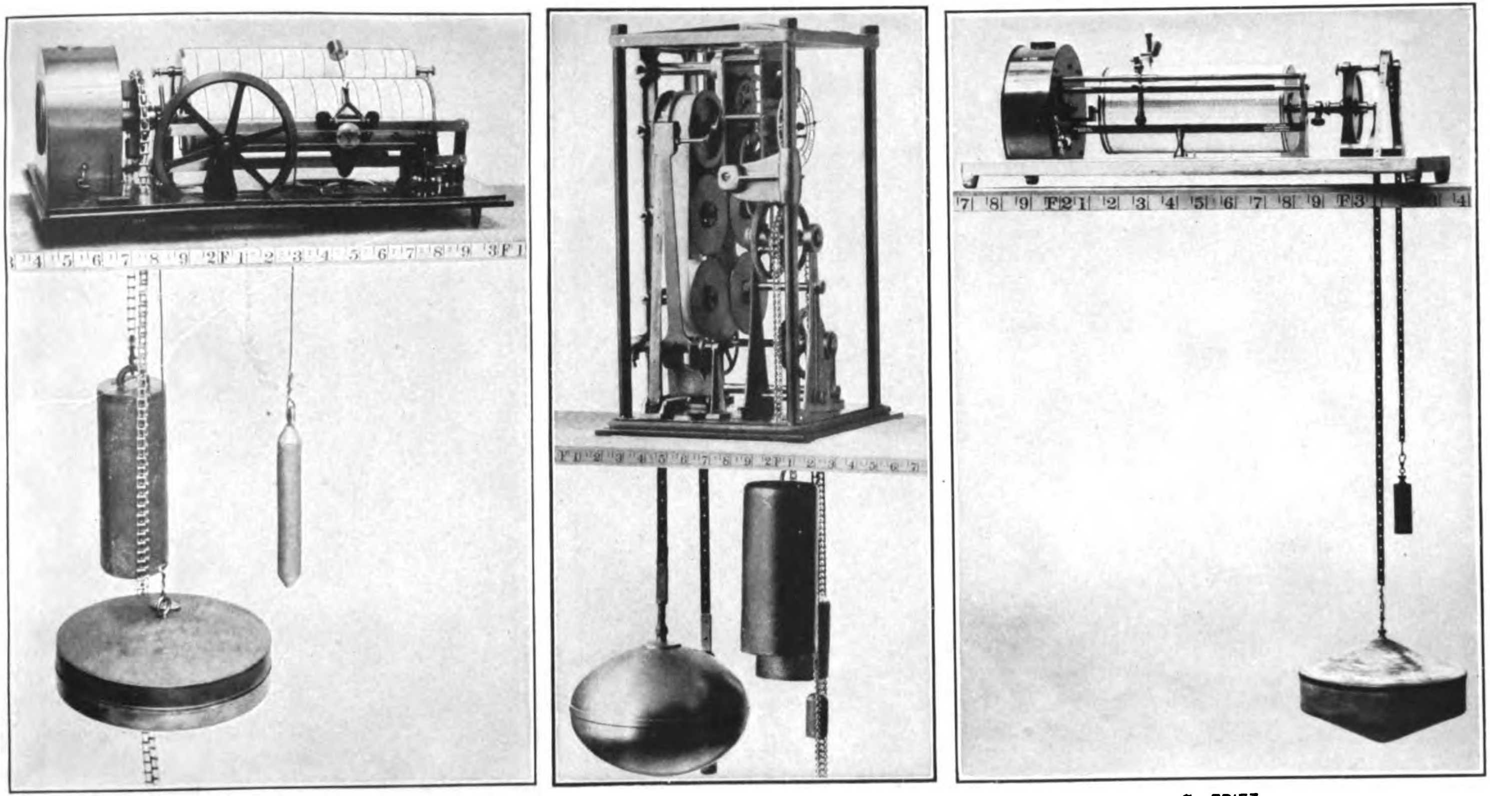
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



A. PRICE CURRENT METERS



B. TYPICAL GAGING STATION.



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WATER-STAGE RECORDERS.

the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 8, are based.

The deficiency table presented for some of the gaging stations shows the number of days in each year on which the mean daily discharge was less than the discharge given in the table. By subtraction the table gives the number of days each year that the mean daily discharge was between the discharges given in the table and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given. If one discharge rating table was used throughout the period covered by the deficiency table, gage heights that correspond to the discharges are also given. For convenience the theoretical horsepower per foot of fall corresponding to the discharge is given in the table on page 8. In using the table for studies of power, allowance should be made for the various losses, the most important being wheel loss and head loss.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanence of the discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

---

[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C., Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53-59, 1916.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

During the year ending September 30, 1916, the work of measuring streams in Texas was carried on under cooperative agreement with the Director of the Federal Survey and the Board of Water Engineers for the State of Texas, consisting of J. C. Nagle, chairman, John Wilson, and E. B. Gore.

Special acknowledgments are due to the United States Reclamation Service and the United States Weather Bureau for equipment used and assistance rendered in Pecos River valley, upper Trinity and Brazos River basins, and Colorado River basin. The United States Weather Bureau furnished a large part of the equipment for the evaporation station near Austin.

The United States Indian Office paid the greater part of the observer's salary at the stations near Taos.

The following cities, organizations, private companies, and railroads have aided in the collection of records by furnishing funds or otherwise assisting: City of San Angelo; city of Corpus Christi; Cuero Commercial Club; San Marcos Utilities Co.; Barstow Irrigation Co.; Imperial Irrigation Co.; Arlington Land Co.; Kansas City, Mexico & Orient Railroad; San Antonio, Uvalde & Gulf Railroad Co.; Pecos Valley Lines; Texas & Pacific Railway; Gulf, Colorado & Santa Fe Railway; and International & Great Northern Railway.

DIVISION OF WORK.

The data for stations in Texas were collected and prepared for publication under the direction of Glenn A. Gray, district engineer, who was assisted by H. J. Dean, assistant engineer; R. C. Pierce and William Kessler, junior engineers; and R. C. Thaxton, Russell J. Hank, Victor Lieb, and W. C. Dodd, State hydrographers.

The data for stations in the Rio Grande drainage basin in New Mexico were collected and prepared for publication under the direction of Robert Follansbee, district engineer, who was assisted by

G. S. Cowdrey, jr., assistant engineer, and W. R. King, H. W. Fear, P. V. Hodges, and H. K. Smith, junior engineers.

The manuscript was assembled and reviewed by H. J. Dean and G. C. Stevens.

GAGING-STATION RECORDS.

TRINITY RIVER BASIN.

TRINITY RIVER AT BRIDGEPORT, TEX.

Location.—At the suspension bridge on Balsora-Bridgeport road, half a mile southwest of center of Bridgeport, Wise County, a quarter of a mile above the Chicago, Rock Island & Gulf Railway Co. pumping plant, and 1 mile below mouth of Gentry Creek.

Drainage area.—1,060 square miles (revised).

Records available.—October 1, 1914, to September 30, 1916. Record of stage has been obtained by United States Weather Bureau from August 16, 1908, to October 16, 1915.

Gage.—Weight-and-tape gage of the Mott type, fastened to downstream side of bridge, 56 feet from north end of guard rail; read by U. E. Byers.

Discharge measurements.—Made from downstream side of bridge or by wading.

Channel and control.—Bed composed of clay, gravel, and sand. Banks are high, slightly wooded, and are overflowed at a stage of 25 feet. Channel straight above and below station for 100 feet. Control is a rock outcrop three-quarters of a mile below station.

Extremes of discharge.—Maximum stage recorded during year, 22.70 feet at 6 p. m. April 2 (discharge, 10,800 second-feet); no flow October 8–11.

1908–1916: Maximum stage recorded, 28.9 feet June 8, 1915 (discharge not determined); no flow October 8–11, 1915.

Ice.—None reported during year.

Diversions.—None above station for power development; extensive irrigation not required, as ordinarily the precipitation in the drainage basin is sufficient to mature crops. The operation of the few small pumping plants along the stream produces little noticeable effect.

Regulation.—Flow unaffected by water-power plants, dams, or reservoirs above or immediately below the station.

Accuracy.—Stage-discharge relation changes slightly. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean-daily gage heights to rating table, except for periods during which stage-discharge relation was affected by shifting control. Results good except for low water for which they are fair.

Cooperation.—Gage-height record for October 1–16 furnished by the United States Weather Bureau.

Discharge measurements of Trinity River at Bridgeport, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	Gray and Thaxton	8.58	1,490	Apr. 5	R. J. Hank	20.06	7,450
Nov. 11	R. C. Thaxton	1.37	7.2	6	.....do	13.44	3,190
Jan. 15	R. C. Pierce	1.59	15.5	6	.....do	12.97	2,950
Mar. 18	R. J. Hank	1.30	4.7	6	.....do	12.35	2,950
Apr. 2	.....do	22.70	10,800	8	.....do	4.25	459
3	.....do	19.60	7,260	June 21	.....do	1.40	4.9
3	.....do	18.56	5,880	Sept. 8	.....do	1.87	27.4
3	.....do	18.41	5,920				

Daily discharge, in second-feet, of Trinity River at Bridgeport, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	7.7	5.7	7.0	152	7.7	3,280	6,360	8.8	2.7	1.3	44
2	8.0	6.0	5.7	20	49	7.7	9,360	2,840	7.3	2.5	1.3	102
3	1.5	3.8	5.7	18	20	7.7	6,600	1,190	6.0	2.4	1.3	59
4	.7	2.4	5.4	15	16	7.7	7,950	676	6.0	2.4	1.2	12
5	.3	2.2	5.0	11	12	7.7	6,800	224	15	2.4	1.2	23
6	.3	2.0	5.0	10	14	7.3	2,780	160	17	2.3	1.2	176
7	.3	6.7	7.0	9.2	14	7.3	1,130	100	14	2.2	1.1	180
8	.0	7.0	7.0	8.4	21	7.0	457	81	12	2.2	1.1	22
9	.0	7.0	6.0	8.4	24	7.0	401	70	10	2.0	1.1	14
10	.0	7.0	5.7	7.7	18	7.0	285	55	8.8	2.0	1.0	17
11	.0	7.0	5.0	7.0	16	7.0	210	43	7.7	2.0	1.0	13
12	.7	7.0	5.0	7.0	12	6.7	119	35	6.0	1.9	1.0	12
13	.7	7.0	5.0	12	12	6.7	71	29	5.4	1.8	.9	10
14	.3	7.0	5.0	57	12	6.4	43	26	20	1.8	.9	8.8
15	.3	6.4	5.0	15	12	6.0	950	26	21	1.7	.9	7.3
16	.7	6.0	6.0	12	11	5.7	655	32	10	1.7	.9	5.7
17	1,180	5.7	7.0	11	10	5.7	682	39	5.0	1.6	.9	5.0
18	744	5.0	7.0	9.2	9.6	5.0	394	32	5.4	1.6	.9	2.5
19	1,160	4.5	6.0	7.0	9.2	5.4	247	28	5.0	1.6	.8	2.0
20	1,600	4.5	6.0	12	8.4	5.0	156	31	4.7	1.6	.7	1.3
21	1,520	4.5	5.7	3,530	8.4	5.0	116	222	5.4	1.5	.7	.9
22	436	4.5	5.0	1,330	10	5.4	86	152	4.3	1.5	.7	.7
23	97	4.5	5.0	1,280	10	5.4	63	114	3.4	1.5	.7	.7
24	45	4.5	5.0	210	10	6.0	81	74	2.9	1.5	.6	.6
25	34	5.0	5.0	97	9.2	197	65	37	2.5	1.5	.5	.6
26	22	6.0	5.0	170	8.4	121	56	27	2.5	1.4	.5	.6
27	20	6.0	5.0	611	8.4	49	49	21	2.5	1.4	.5	.6
28	16	6.0	5.0	210	8.0	20	37	17	2.4	1.4	.5	.5
29	15	6.0	5.0	58	7.7	9.2	24	15	2.5	1.3	.5	.5
30	13	6.0	5.0	105	....	8.0	17	13	2.7	1.3	.5	.5
31	9.2	....	6.4	462	....	7.3	....	10	....	1.3	.4	....

NOTE.—Discharge determined as follows: Oct. 1-16 and Oct 24 to May 1, from a well-defined rating curve; May 6 to Sept. 30, from a parallel rating curve; Oct. 17-23 and May 2-5, by indirect method for shifting control.

Monthly discharge of Trinity River at Bridgeport, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,600	0.0	224	13,800
November	7.7	2.0	5.50	327
December	7.0	5.0	5.56	342
January	3,530	7.0	269	16,500
February	152	7.7	18.4	1,060
March	197	5.0	18.3	1,130
April	9,360	17	1,440	85,700
May	6,360	10	412	25,300
June	21	2.4	7.54	449
July	2.7	1.3	1.81	111
August	1.3	.4	.86	53
September	180	.5	24.1	1,430
The year	9,360	.0	201	146,000

BRAZOS RIVER BASIN.

BRAZOS RIVER NEAR GRAHAM, TEX.

Location.—At the two-span steel highway bridge on the Murray road, 6 miles above mouth of Clear Fork, 10 miles west of Graham, Young County.

Drainage area.—12,900 square miles.

Records available.—November 13, 1915, to September 30, 1916.

Gage.—Vertical staff on left downstream corner of middle pier; read by Mrs. John Timmons.

Discharge measurements.—Made from upstream side of bridge or by wading.

Channel and control.—Channel straight above and below station. Bed composed of sand and clay; free from vegetation, shifting. Left bank high and not subject to overflow; right bank is of medium height and is overflowed during high stages.

Extremes of discharge.—Maximum stage recorded during year, 9.50 feet at 6 p. m. April 2 (discharge, 4,100 second-feet; result obtained from extension of rating curve and possibly subject to considerable error); no flow March 29 and 30, and August 10–31.

Ice.—Slight amount of ice reported in January.

Diversions.—No information available to show that water is diverted above station in any large quantity for irrigation; no diversions between station and mouth of Clear Fork.

Regulation.—Number of power plants and controlling works above station not known; gage-height record does not indicate that flow is regulated.

Accuracy.—Stage-discharge relation not permanent; not affected by ice during the year. Rating curve poorly defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table except for periods during which stage-discharge relation is affected by shifting control. Determinations of discharge above 2,000 second-feet obtained from an extension of rating curve and subject to considerable error. Results poor.

Discharge measurements of Brazos River near Graham, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	Thaxton and Gray	6.57	1,450	Apr. 4	R. J. Hank	6.52	1,760
Nov. 13	R. C. Thaxton	4.41	86	7	.....do	6.25	1,020
Jan. 17	R. C. Pierce	[a] 3.70	9.7	June 22	.....do	4.71	41.5
Mar. 20	R. J. Hank	3.33	[b] 1.5	Sept. 9	.....do	4.90	164

[a] River frozen over in places but stage discharge relation not appreciably affected.

[b] Estimated.

Daily discharge, in second-feet, of Brazos River near Graham, Tex., for the year ending Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		12	15	13	4.0	219	572	732	462	3.4	1.0
2		13	13	12	2.8	2,860	210	551	254	3.0	3.4
3		13	16	11	2.6	3,390	101	420	173	5.6	1,600
4		13	12	14	1.8	1,920	96	249	66	6.2	1,800
5		13	13	14	3.0	1,590	151	177	53	4.6	996
6		13	13	15	2.6	1,310	274	109	32	3.4	716
7		20	13	14	2.2	1,080	139	614	18	2.2	593
8		24	13	12	2.0	1,070	46	558	14	1.6	289
9		15	13	13	1.0	635	31	444	10	1.0	166
10		17	12	10	1.0	474	34	378	5.4	.0	177
11		17	10	12	3.0	294	27	223	4.6	.0	127
12		13	10	11	3.0	219	22	860	5.0	.0	89
13	86	13	10	10	1.8	148	21	1,040	4.6	.0	80
14	71	13	13	8.5	.6	450	16	748	3.8	.0	76
15	34	13	13	8.5	.9	1,610	22	558	3.4	.0	92
16	34	17	10	7.6	1.2	1,160	24	426	4.0	.0	72
17	29	40	10	6.6	1.4	656	18	289	4.4	.0	58
18	24	63	12	5.0	.6	495	12	133	4.8	.0	47
19	24	47	12	5.0	.4	354	11	87	5.0	.0	23
20	24	34	14	5.0	1.8	206	10	74	4.2	.0	18
21	24	34	37	5.0	1.2	289	1,720	57	4.0	.0	16
22	20	34	26	5.4	1.0	191	724	37	4.8	.0	13
23	17	34	16	5.2	1.8	139	462	26	4.0	.0	12
24	13	34	15	5.4	1.0	89	330	21	4.0	.0	11
25	13	24	13	5.0	1.4	52	142	15	3.8	.0	28
26	15	24	17	4.2	1.2	74	89	12	3.0	.0	18
27	13	24	14	3.4	1.0	65	58	33	2.8	.0	19
28	13	15	15	2.6	.2	71	2,220	916	2.4	.0	115
29	10	12	17	3.4	.0	402	820	812	3.0	.0	127
30	10	13	284		.0	544	1,250	488	3.6	.0	84
31		13	15		1.0		1,080		2.8	.0	

NOTE.—Discharge determined from rating table Nov. 13 to Mar. 31 and by indirect method for shifting control Apr. 1 to Sept. 30.

Monthly discharge of Brazos River near Graham, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 13–30	86	10	26.3	989
December	63	12	22.1	1,360
January	284	10	23.0	1,410
February	15	2.6	8.51	490
March	4.0	.0	1.53	94
April	3,390	52	735	43,700
May	2,220	10	346	21,300
June	1,040	12	370	22,000
July	462	2.4	37.7	2,320
August	6.2	.0	1.00	61
September	1,800	1.0	249	14,800
The period				108,000

BRAZOS RIVER AT BRAZOS, TEX.

Location.—At Texas & Pacific Railway bridge half a mile northeast of Brazos, Palo Pinto County, 1½ miles above mouth of Palo Pinto Creek.

Drainage area.—20,200 square miles (revised).

Records available.—October 1, 1914, to September 30, 1916. Records of stage have been obtained by the United States Weather Bureau since August 16, 1908.

Gage.—Vertical staff on northwest side of and one foot from upstream edge of pier nearest the middle of the railway bridge; graduations above 4 feet painted on the pier; read by L. W. Boyett.

Discharge measurements.—Made from three-span highway bridge about 600 feet below railway bridge.

Channel and control.—Bed composed of sand and gravel; shifts slightly at low water. Right bank high, rocky, wooded, and not subject to overflow; left bank composed of sand, gravel, and clay, wooded, medium in height, and subject to overflow at high water. Channel straight above and below for several thousand feet.

Extremes of discharge.—Maximum stage recorded during year, 9.60 feet at 7 a. m., April 2 (discharge, 42,500 second-feet; result obtained from extension of rating curve and possibly subject to considerable error); minimum stage, no flow August 25 to September 1.

1908-1916: Maximum stage recorded, 22.0 feet May 24, 1908 (discharge not determined); no flow for several periods within limits of observations.

Ice.—None reported during year.

Diversions.—A few pumping plants have been installed along the stream for the purpose of irrigating small areas, but water so pumped will not greatly affect the flow of the stream.

Regulation.—Flow unaffected by power plants, dams, or reservoirs above or immediately below station. Swamps and natural lakes are rare in the drainage basin above the station.

Accuracy.—Stage-discharge relation not permanent. Two rating curves, each fairly well defined below 18,000 second-feet, were used during the year. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating tables. Results fair. Determinations for extremely high stages obtained from extension of the rating curve and may be considerably in error.

Cooperation.—Record of gage height October 1-19 furnished by the United States Weather Bureau.

Discharge measurements of Brazos River at Brazos, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	Gray and Thaxton	6.90	12,000	Apr. 3	William Kessler	7.47	17,000
Nov. 10	R. C. Thaxton	1.45	272	June 26	R. J. Hank	1.20	130
Jan. 20	R. C. Pierce	.90	49.6	Sept. 11	do	1.60	344
Mar. 26	R. J. Hank	.48	27.3				

Daily discharge, in second-feet of Brazos River at Brazos, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,880	695	130	88	180	40	4,730	3,710	6,720	660	20	0.0
2	2,430	625	130	88	130	37	35,900	7,450	2,960	1,760	18	.8
3	2,150	625	130	88	130	37	14,400	6,720	1,640	1,300	17	45
4	1,890	555	130	88	130	37	9,400	5,450	1,250	930	14	30
5	1,640	555	130	88	130	37	4,440	2,360	850	639	12	20
6	1,520	485	130	88	130	37	3,890	1,410	555	471	11	1,520
7	1,410	485	130	88	88	37	3,890	1,060	625	402	11	1,520
8	1,300	415	88	88	83	37	2,730	850	485	338	11	1,100
9	1,200	415	88	64	64	34	2,080	834	415	279	11	770
10	1,100	320	88	64	64	34	1,860	755	450	222	11	520
11	1,010	290	88	64	61	34	1,660	681	850	170	11	382
12	930	290	88	64	50	32	1,320	611	590	122	11	338
13	850	233	88	64	50	32	1,060	541	485	83	11	279
14	770	233	88	64	50	32	890	471	471	64	8.5	222
15	695	233	88	64	50	30	732	402	415	64	8.5	170
16	625	233	88	64	50	30	2,700	338	1,460	69	8.5	122
17	625	180	88	64	50	30	4,930	290	1,220	76	6.0	88
18	555	180	88	50	50	28	2,960	290	970	50	6.0	88
19	17,300	180	88	50	50	28	2,150	290	786	48	6.0	83
20	10,700	180	88	50	46	28	2,020	290	590	45	4.0	64
21	5,700	180	88	50	46	28	1,410	290	450	40	2.8	64
22	3,890	180	88	50	46	28	970	429	338	40	2.0	61
23	2,580	180	88	930	46	28	732	890	279	36	1.0	50
24	2,500	180	88	611	43	28	625	1,700	233	36	1.0	50
25	2,020	180	88	485	43	28	590	1,200	222	32	.0	50
26	1,580	180	88	320	43	28	471	786	155	28	.0	48
27	1,360	180	88	222	40	28	402	590	130	28	.0	40
28	1,060	180	88	190	40	28	350	450	122	26	.0	40
29	890	180	88	180	40	28	350	338	109	24	.0	38
30	732	180	88	180	......	28	350	279	88	24	.0	32
31	695	......	88	180	......	28	......	1,960	......	24	.0	......

NOTE.—Discharge determined from two rating tables applicable Oct. 1 to July 18 and July 19 to Sept. 30.

Monthly discharge of Brazos River at Brazos, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	17,300	555	2,410	148,000	C.
November	695	180	307	18,300	C.
December	130	88	97.5	6,000	C.
January	930	50	155	9,530	C.
February	180	40	69.8	4,010	C.
March	40	28	31.6	1,940	C.
April	35,900	350	3,670	218,000	C.
May	7,450	279	1,410	86,700	C.
June	6,720	88	864	51,400	C.
July	1,760	24	262	16,100	C.
August	20	.0	7.20	443	C.
September	1,520	.0	261	15,500	C.
The year	35,900	.0	794	576,000	

BRAZOS RIVER AT WACO, TEX.

LOCATION.—At suspension bridge on Bridge Street, in city of Waco, McLennan County, just below Southern Traction Co.'s bridge, 2½ miles below mouth of Bosque River, 4½ miles above mouth of Cottonwood Creek, about 10 miles above lock No. 8, now under construction.

DRAINAGE AREA.—25,500 square miles (revised).

Records available.—September 14, 1898, to December 31, 1911; October 1, 1914, to September 30, 1916. Record of stage has been obtained by United States Weather Bureau since August 9, 1900.

Gage.—Chain gage attached to downstream guard rail of bridge about 70 feet from southwest pier; read by A. E. Howell. Gage used from September 14, 1898, to February 29, 1908, was an inclined staff gage under left end of bridge. In 1902 a gage agreeing in datum with the inclined gage was marked off on the north pier of a new single-span highway bridge about 300 feet above the suspension bridge, and was used for high-water readings. From August 9, 1900, to May 21, 1902, the United States Weather Bureau used a vertical gage painted on the pier nearest the center of the St. Louis Southwestern Railway bridge. From September 25, 1914, to March 23, 1915, during reconstruction of suspension bridge, chain gage was on the one-span highway bridge. All gages were installed at same datum, but readings probably differ slightly because of differences in position.

Discharge measurements.—Made from downstream side of first one-span highway bridge above station.

Channel and control.—Bed composed of sand and gravel; shifts. Banks are clay, medium in height, have been improved by the city, and are overflowed at extreme high water. Channel straight above and below for several thousand feet. Position of control not known.

Extremes of discharge.—Maximum stage recorded during year, 33.8 feet at 8 a. m. April 2 (discharge, 113,000 second-feet; result obtained from extension of rating curve possibly subject to large error); minimum stage, 5.48 feet August 30 and 31 and September 1 and 2 (discharge, 119 second-feet).

1889–1916: Maximum stage recorded, 39.7 feet December 3, 1913 (discharge not determined); minimum stage, 2.00 feet March 8–10, 1902 (discharge, 20 second-feet).

Ice.—None reported during year.

Diversions.—So far as is known there are no diversions of any magnitude above station. Small areas of land are irrigated above station, but quantity of water diverted is only a small percentage of the total flow.

Regulation.—Lock No. 8 will eventually control flow at this station; flow only slightly controlled at present.

Accuracy.—Stage-discharge relation not permanent. Rating curve used as basis for ascertaining discharge by indirect method is fairly well defined. Gage read to quarter-tenths once daily. Slight errors may be introduced by taking one daily gage reading as the mean for the day. Daily discharge ascertained by indirect method for shifting control. Results fair.

Coöperation.—Record of gage heights October 1–23 furnished by United States Weather Bureau.

Discharge measurements of Brazos River at Waco, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	Gray and Thaxton	9.56	4,700	May 3	Kessler and Thaxton	16.76	28,500
Nov. 16	R. C. Thaxton	6.64	465	3	.....do	15.71	23,500
Jan. 21	R. C. Pierce	7.63	1,080	4	William Kessler	12.72	11,900
Mar. 17	R. J. Hank	6.58	374	4	.....do	12.42	10,900
Apr. 2	William Kessler	33.36	[a]109,000	June 27	R. J. Hank	7.13	751
4	.....do	15.69	19,000	Sept. 12	.....do	7.62	1,180
9	R. J. Hank	12.14	9,900				

[a] Only surface velocities obtained; coefficient of 0.88 used to reduce to mean velocity.

Daily discharge, in second-feet, of Brazos River at Waco, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6,230	1,280	316	296	8,050	607	50,700	5,750	1,270	489	215	119
2	5,600	1,130	288	338	3,400	594	97,800	45,600	1,120	467	220	119
3	4,550	1,040	274	338	2,690	533	46,100	25,700	955	715	200	125
4	3,620	880	282	378	2,360	522	21,000	12,500	5,540	436	192	200
5	2,720	730	324	414	2,210	478	18,600	13,500	3,570	1,310	180	555
6	2,270	672	316	360	1,940	533	10,000	10,300	2,680	478	245	760
7	1,970	646	937	360	1,680	522	46,500	7,450	2,500	1,580	200	415
8	1,580	594	872	330	1,540	489	18,800	6,040	6,640	1,360	180	348
9	1,360	544	1,040	324	1,510	478	10,000	4,860	4,250	1,090	172	306
10	1,270	522	640	324	1,430	489	8,050	4,070	2,220	880	172	245
11	1,270	467	427	324	1,320	450	6,900	3,350	1,780	708	160	278
12	1,270	467	396	320	1,310	436	5,680	2,770	1,390	607	265	1,180
13	1,360	427	352	310	1,130	436	4,840	2,340	1,060	533	245	1,090
14	1,360	594	334	274	1,010	436	4,420	2,140	937	478	215	910
15	1,270	467	334	264	982	404	3,760	1,850	10,000	436	186	672
16	1,090	436	373	264	964	391	13,800	1,610	6,610	400	172	533
17	910	400	341	242	895	378	5,470	1,430	3,550	382	156	400
18	1,840	355	341	235	880	391	4,840	7,780	2,090	382	140	341
19	3,440	338	440	235	820	391	3,980	6,330	3,190	320	137	285
20	5,200	327	418	327	805	404	3,480	3,480	2,330	285	137	260
21	11,100	327	494	880	820	404	5,470	10,000	1,920	391	125	240
22	8,510	302	427	3,730	805	391	4,380	3,730	1,680	278	122	220
23	5,620	302	396	2,360	790	391	3,870	2,570	1,400	320	225	215
24	4,660	327	382	1,480	745	382	3,800	2,330	1,160	250	160	200
25	4,250	334	316	3,550	745	404	2,850	1,920	1,040	245	137	196
26	3,930	288	306	2,690	692	382	2,300	1,610	880	250	125	196
27	3,300	274	302	6,100	659	348	1,840	1,430	745	240	140	250
28	2,540	274	296	3,910	692	348	1,630	2,660	659	240	137	400
29	2,280	248	288	2,860	626	895	1,490	2,300	730	225	125	220
30	1,890	274	296	2,630	....	805	1,360	1,760	581	232	119	180
31	1,560	....	302	9,620	....	646	....	1,460	....	220	119	....

Monthly discharge of Brazos River at Waco, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	11,100	910	3,220	198,000
November	1,280	274	509	30,300
December	1,040	274	415	25,500
January	9,620	235	1,490	91,600
February	8,050	626	1,500	86,300
March	895	348	476	29,300
April	97,800	1,360	13,800	821,000
May	45,600	1,430	6,470	398,000
June	10,000	581	2,480	148,000
July	1,580	220	523	32,200
August	285	119	172	10,600
September	1,180	119	383	22,800
The year	97,800	119	2,610	1,890,000

Days of deficiency in discharge of Brazos River at Waco, Tex., for the years ending Sept. 30, 1901–1910 and 1915–16.

Discharge in second-feet.	Days of deficient discharge.											
	1900–01	1901–2	1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10	1914–15	1915–16
100	34	76	1	14	......	......	......	......	203	144	......	......
200	73	124	17	98	15	......	1	2	260	220	......	32
300	115	141	33	125	63	16	17	20	287	246	4	76
400	164	152	42	148	98	79	61	31	300	260	28	132
500	199	163	71	181	126	106	102	43	307	282	38	164
600	220	177	98	202	136	130	131	56	310	293	42	177
700	242	192	130	215	141	145	153	65	314	294	49	189
800	256	206	168	239	153	160	179	73	315	305	53	198
900	266	222	184	254	161	168	220	97	317	310	67	211
1,000	274	235	192	260	164	172	233	109	317	314	83	218
1,200	288	250	217	280	184	196	265	153	326	322	124	231
1,400	296	265	230	286	195	210	271	183	328	329	152	247
1,600	299	279	243	298	214	233	290	218	335	336	176	258
1,800	301	292	256	300	227	242	298	232	340	338	199	265
2,000	306	302	259	304	233	249	302	250	341	341	204	273
2,500	314	314	274	313	245	279	317	274	345	347	223	287
3,000	326	323	293	322	252	297	325	291	348	348	245	298
4,000	337	327	320	333	274	315	338	307	353	350	277	317
5,000	345	337	332	344	291	322	347	318	356	351	294	327
6,000	349	342	339	349	308	335	354	325	358	352	306	335
7,000	352	346	342	354	314	340	355	329	358	355	314	342
8,000	354	350	348	356	320	343	357	333	360	357	316	344
9,000	357	351	352	357	329	347	358	335	360	357	321	347
10,000	358	352	354	360	331	352	359	337	360	357	326	352
15,000	361	357	359	364	343	359	365	343	360	362	339	357
20,000	363	359	361	365	354	361	......	348	362	362	344	359
40,000	365	361	365	366	362	364	......	356	365	365	354	361
60,000	......	363	......	......	364	365	......	359	......	......	357	365
80,000	......	365	......	......	364	......	......	360	......	......	361	365
100,000	......	......	......	......	365	......	......	363	......	......	365	366
150,000	......	......	......	......	......	......	......	366	......	......	......	......

CLEAR FORK OF BRAZOS RIVER NEAR ELIASVILLE, TEX.

Location.—At new suspension highway bridge 2½ miles northeast of Eliasville, Young County, 4½ miles southwest of South Bend, 6 miles above mouth of stream, and below all tributaries.

Drainage area.—5,650 square miles.

Records available.—November 12, 1915, to September 30, 1916.

Gage.—Chain gage attached to downstream handrail of bridge; read by Alice Vaughn.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Banks high, wooded, composed of clay and gravel, and not subject to overflow. Bed composed of sand and gravel; free from vegetation. Channel straight above and below station. A shoal about 600 feet below station serves as control for low and medium stages; control shifts slightly during changing stages.

Extremes of discharge.—Maximum stage recorded during year, 18.2 feet 6 p. m. May 2 (discharge, 7,800 second-feet; result obtained from extension of rating curve and possibly subject to considerable error); no flow August 23 to September 30.

Ice.—None reported during year.

Diversions.—Much of the land now irrigated above station is in Jones and Taylor counties. Two diversions are made for irrigation between station and confluence of Clear Fork with Brazos River. Quantity of water diverted unknown. According to the First Report of the Board of Water Engineers for the State of Texas, the Sweetwater Light & Power Co. has filed on 100 acre-feet of water for storage in the headwater region.

Regulation.—No large reservoir above or below station. The operation of a water-power gristmill 5 miles upstream produces some effect at the station.

Accuracy.—Stage-discharge relation not permanent. Rating curve fairly well defined below 2,000 second-feet and poorly defined above. Gage read to hundredths twice daily; observer's work not entirely satisfactory; mean daily gage height may not be true index of daily flow because of regulation for power. Daily discharge ascertained by applying mean daily gage height to rating table except for periods during which stage-discharge relation is affected by shifting control. Results fair.

Discharge measurements of Clear Fork of Brazos River near Eliasville, Tex., during th year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	Gray and Thaxton	5.55	586	Apr. 4	R. J. Hank	7.74	1,610
Nov. 12	R. C. Thaxton	3.11	6.6	7	do	4.69	127
Jan. 17	R. C. Pierce	2.91	1.7	June 22	do	3.81	52.
Mar. 19	R. J. Hank	3.00	3.4	Sept. 9	do	2.69	.

Daily discharge, in second-feet, of Clear Fork of Brazos River near Eliasville, Tex., for th year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1			2.6	3.2	1.2	1.6	533	193	368	386	14	0.
2			2.6	3.2	1.4	1.6	7,200	7,400	136	190	14	.
3			2.6	3.0	1.4	1.6	3,200	1,240	104	130	12	.
4			2.2	3.2	1.4	1.6	1,560	276	77	124	11	.
5			2.3	3.5	1.4	1.6	1,080	213	63	116	10	.
6			2.2	3.5	1.4	1.6	311	108	50	96	10	.
7			2.3	2.9	1.7	1.6	129	102	47	82	10	.
8			2.3	3.5	1.4	1.6	172	79	38	72	10	.
9			2.3	4.5	1.4	1.6	138	58	33	52	6.8	.
10			2.6	4.0	1.4	1.6	81	48	30	52	5.0	.
11			2.6	3.2	1.4	1.6	71	44	21	52	4.5	.
12		6.4	3.2	3.2	1.4	1.6	51	44	21	52	3.5	.
13		7.6	2.6	2.8	1.4	1.6	51	40	21	52	3.5	.
14		4.0	2.4	3.5	1.6	1.6	51	40	15	43	3.5	.
15		3.8	2.3	3.5	1.6	1.6	51	28	15	35	3.4	.
16		4.8	5.0	4.0	1.4	1.6	51	24	148	35	2.6	.
17		5.0	5.2	3.2	1.4	1.6	51	24	95	35	2.0	.
18		4.5	5.8	1.2	1.4	1.6	51	24	71	35	.5	.
19		5.0	5.0	1.2	1.4	3.5	51	17	51	35	.5	.
20		5.5	5.5	1.4	1.4	2.0	51	17	44	33	.5	.
21		4.0	5.0	1.4	1.4	2.0	51	17	44	31	.5	.
22		3.8	5.0	1.4	1.6	2.0	47	17	44	31	.4	.
23		3.4	5.0	1.4	1.4	2.0	42	17	58	27	.0	.
24		3.8	5.0	1.6	1.2	2.0	41	16	57	27	.0	.
25		3.5	5.0	1.4	1.2	2.0	41	26	52	27	.0	.
26		3.4	5.0	1.4	1.6	2.0	33	38	52	27	.0	.
27		3.5	4.8	1.4	1.2	2.0	25	38	52	27	.0	.
28		3.5	4.5	1.4	1.2	2.0	25	38	64	27	.0	.
29		3.2	4.2	1.4	1.2	2.0	25	1,080	1,660	20	.0	.
30		2.9	4.5	1.4		2.0	33	5,200	1,040	14	.0	.
31			4.5	1.4		2.0		3,100		14	.0	

Note.—Discharge determined as follows: Nov. 12 to Apr. 4, and May 2 to Sept. 30 from rating tables Apr. 5 to May 1, by indirect method for shifting control.

Monthly discharge of Clear Fork of Brazos River near Eliasville, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 12–30	7.6	2.9	4.29	162
December	5.8	2.2	3.75	231
January	4.5	1.2	2.49	153
February	1.7	1.2	1.40	81
March	3.5	1.6	1.82	112
April	7,200	25	510	30,300
May	7,400	16	629	38,700
June	1,660	15	152	9,040
July	386	14	63.8	3,920
August	14	.0	4.14	255
September	.0	.0	.00	0
The period				83,000

COLORADO RIVER BASIN.

COLORADO RIVER NEAR BRONTE, TEX.

Location.—At wagon bridge 400 feet below Kansas City, Mexico & Orient Railroad bridge 1½ miles above mouth of Kickapoo Creek and below mouth of Live Oak Creek, 2½ miles south of Bronte, Coke County.

Drainage area.—5,550 square miles.

Records available.—September 19, 1915, to September 30, 1916.

Gage.—Chain gage attached to downstream side of bridge near left bank; read by R. W. Legg. A vertical staff gage attached to left bent of railroad bridge 400 feet above present site and referred to same datum was used from September 19, 1915, to October 29, 1915.

Discharge measurements.—Made from downstream side of bridge or by wading.

Channel and control.—Bed composed of a clay hardpan mixed with gravel; shifts. Channel straight about 500 feet above and below station. Right bank wooded, sloping, and subject to overflow at extreme stages; left bank high, clean, and not subject to overflow. Control probably at shoal 300 feet below gage.

Extremes of discharge.—1915–16: Maximum stage recorded during year, 15.0 feet at 2 a. m. September 25, 1916 (discharge not determined); no flow May 13–29, June 8 to July 29, and August 6–21.

Ice.—None reported during year.

Diversions.—Some water is diverted for irrigating small areas in Coke and Mitchell counties and for municipal use of the city of Robert Lee. No large irrigation projects in drainage basin above station. The First Report of the Board of Water Engineers for the State of Texas records a filing at Robert Lee on a small quantity of water for storage, but this storage will not influence flow at station.

Regulation.—Flow not affected by water-power plants or controlling works.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined below 400 second-feet and is an extension above 450 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table except for periods during which stage-discharge relation is affected by ice. Results fair.

Discharge measurements of Colorado River near Bronte, Tex., during the period Sept. 19, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 19	Hank and Thaxton	2.62	156	Apr. 28	Hank and Gray	1.82	13.0
Oct. 29	R. J. Hank	1.87	28.5	June 20	R. J. Hank	1.43	.0
Dec. 18	.....do	1.61	3.7	Aug. 28	William Kessler	2.19	64.5
				28	.....do	2.10	51.0
1916.				29	.....do	2.00	32.6
Feb. 10	.....do	1.52	1.6	Sept. 5	R. J. Hank	2.65	179
Mar. 27	.....do	1.45	a.4	29	.....do	1.90	27.4

a Estimated.

Daily discharge, in second-feet, of Colorado River near Bronte, Tex., for the period Sept. 19, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1		107	18	2.8	2.2	2.2	1.4	272	217	36	0.0	8.0	63
2		87	16	2.8	2.2	2.2	1.4	63	49	18	.0	3.4	22
3		67	16	2.8	2.2	2.2	1.4	312	25	12	.0	1.8	118
4		49	16	2.8	4.1	2.2	1.4	440	14	8.0	.0	1.1	101
5		33	10	2.8	3.4	2.2	1.4	280	17	6.3	.0	1.1	162
6		26	10	14	3.0	2.2	1.1	169	11	5.5	.0	.0	93
7		20	10	15	3.0	1.8	.8	114	9.5	4.8	.0	.0	51
8		18	10	9.0	3.0	1.8	.8	79	9.0	.0	.0	.0	29
9		16	9.5	9.0	3.0	1.8	.8	53	7.0	.0	.0	.0	16
10		12	8.0	7.0	2.6	1.8	.3	36	6.3	.0	.0	.0	16
11		11	5.2	4.8	2.6	1.8	.3	29	6.3	.0	.0	.0	10
12		11	4.8	4.8	2.6	1.8	.3	25	5.2	.0	.0	.0	9.5
13		9.5	4.8	4.1	2.6	1.8	.3	20	.0	.0	.0	.0	8.5
14		8.0	4.5	4.1	2.4	1.8	.3	1,300	.0	.0	.0	.0	5.2
15		8.0	4.5	4.1	2.4	1.8	.3	292	.0	.0	.0	.0	5.6
16		7.0	4.5	4.1	2.4	1.6	.3	212	.0	.0	.0	.0	3.8
17		23	4.5	4.1	1.8	1.4	.3	171	.0	.0	.0	.0	23
18		926	4.5	3.8	2.4	1.4	.3	155	.0	.0	.0	.0	18
19	155	974	4.5	3.8	2.4	1.4	.3	120	.0	.0	.0	.0	13
20	97	541	4.5	3.4	2.4	1.4	.3	81	.0	.0	.0	.0	9.5
21	53	342	4.8	3.4	2.4	1.4	.3	67	.0	.0	.0	.0	5.9
22	33	201	4.5	3.2	2.2	1.4	.3	36	.0	.0	.0	1.4	4.5
23	1,050	151	4.1	2.8	2.2	1.4	.3	25	.0	.0	.0	330	49
24		118	3.8	2.6	2.2	1.4	.3	19	.0	.0	.0	233	310
25	417	83	3.4	2.4	2.2	1.4	.3	16	.0	.0	.0	699	1,160
26	900	63	3.0	2.4	2.2	1.4	.3	13	.0	.0	.0	252	160
27	651	53	2.4	2.4	2.2	1.4	.3	23	.0	.0	.0	122	89
28	485	41	3.4	2.4	2.2	1.4	.3	14	.0	.0	.0	83	49
29	330	23	3.4	2.2	2.2	1.4	.3	9.5	.0	.0	.0	28	25
30	155	21	3.4	2.2	2.2		.3	79	169	.0	4.5	15	16
31		20		2.2	2.2		.8		75		23	11	

NOTE.—Discharge determined as follows: Sept. 19 to Oct. 17, 1915, and Nov. 11, 1915, to Sept. 2, 1916, from rating table; Oct. 18 to Nov. 10, 1915, and Sept. 3–30, 1916, by indirect method for shifting control. Mean daily gage height Sept. 24, 1915, 8.55 feet; mean discharge estimated at slightly over 2,000 second-feet.

Monthly discharge of Colorado River near Bronte, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	974	7.0	132	8,120
November	18	2.4	6.87	409
December	15	2.2	4.43	272
January	4.1	1.8	2.49	153
February	2.2	1.4	1.70	98
March	1.4	.3	.57	35
April	1,300	9.5	151	8,980
May	217	.0	20.0	1,230
June	36	.0	3.02	180
July	23	.0	.89	55
August	699	.0	57.7	3,550
September	1,160	3.8	88.2	5,250
The year	1,300	.0	39.1	28,300

COLORADO RIVER AT BALLINGER, TEX.

Location.—At Hutchins Avenue highway bridge, 800 feet below Gulf, Colorado & Santa Fe Railway bridge in Ballinger, Runnels County, 1 mile above mouth of Elm Creek.

Drainage area.—6,460 square miles (revised).

Records available.—December 11, 1915, to September 30, 1916. Records of stage have been obtained by the United States Weather Bureau since July 1, 1903. Current-meter measurements were begun May 29, 1915.

Gage.—Chain gage attached to downstream handrail of bridge; read by E. M. Eubank.

Discharge measurements.—Made from downstream side of bridge or by wading.

Channel and control.—Banks consist of clay and gravel; medium height and wooded; subject to overflow at extremely high stages. Bed composed of hard clay, sand, and gravel; somewhat shifting. Control is shoal about 1,000 feet below gage; subject to change.

Ice.—None reported during year.

Extremes of discharge.—Maximum stage recorded during year 9 feet at 9 a. m. September 25 (discharge, 6,300 second-feet; result obtained from extension of rating curve and possibly subject to considerable error). No flow July 3 to August 26 and September 16–24.

Diversions.—During low stages a large part of the flow is diverted above the station by gravity or by pumping, but the quantity diverted is small in comparison with the total run-off.

Regulation.—No artificial regulation above station.

Accuracy.—Stage-discharge relation not permanent. Rating curve fairly well defined below 600 second-feet and is an extension above that discharge. Gage read to hundredths once daily; readings for some days questionable. Daily discharge ascertained by applying daily gage heights to rating table except for periods during which stage-discharge relation is affected by shifting control. Results below 1,000 second-feet are fair; above 1,000 second-feet they may be subject to considerable error.

Discharge measurements of Colorado River at Ballinger, Tex., during the period May 29, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 29	M. R. Hall	[a]0.75	46	Apr. 2	R. C. Thaxton	1.86	397
Sept. 16	Gray and Hank	1.73	253	27	Hank and Gray	.93	29.3
Oct. 23	R. J. Hank	1.61	243	June 17	R. J. Hank	.65	2.5
Dec. 11	do	.87	20.5	Aug. 30	William Kessler	.94	34
				Sept. 6	R. J. Hank	1.26	133
1916.				27	do	1.25	149
Feb. 12	do	.81	8.7				
Mar. 29	do	.52	[b].1				

[a] Gage height May 29 refers to U. S. Weather Bureau gage; relation to Survey chain gage not known.

[b] Discharge estimated.

Daily discharge, in second-feet, of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	12	11	4.0	21	147	11	4.0	0.0	219
2	....	11	11	4.0	409	601	11	2.0	.0	84
3	....	11	11	4.0	196	147	11	.0	.0	259
4	....	11	11	4.0	886	114	11	.0	.0	50
5	....	12	11	4.0	491	35	11	.0	.0	33
6	....	11	11	4.0	447	31	11	.0	.0	29
7	....	9.6	11	4.0	302	28	11	.0	.0	18
8	....	10	11	4.0	196	26	11	.0	.0	15
9	....	9.6	11	3.4	138	23	11	.0	.0	7.5
10	....	11	11	3.6	81	24	11	.0	.0	18
11	29	18	11	3.4	67	24	7.5	.0	.0	18
12	14	16	11	3.6	62	24	4.0	.0	.0	18
13	12	15	11	3.8	62	24	4.7	.0	.0	18
14	11	12	11	3.2	1,140	24	5.4	.0	.0	11
15	21	11	11	3.6	579	24	26	.0	.0	2.0
16	28	14	11	3.4	293	219	24	.0	.0	.0
17	31	11	11	2.8	154	24	24	.0	.0	.0
18	24	16	11	2.2	70	259	4.0	.0	.0	.0
19	14	18	11	2.2	62	137	4.0	.0	.0	.0
20	14	11	11	2.2	38	130	24	.0	.0	.0
21	18	11	11	2.0	37	42	4.0	.0	.0	.0
22	14	11	11	2.8	37	42	3.8	.0	.0	.0
23	16	11	11	2.8	38	42	3.6	.0	.0	.0
24	16	11	11	2.8	40	42	4.0	.0	.0	.0
25	14	11	11	2.4	40	24	3.6	.0	.0	5,500
26	14	11	4.0	2.2	33	24	4.0	.0	.0	976
27	14	11	4.0	2.0	26	24	3.6	.0	98	147
28	11	11	4.0	1.8	37	24	3.6	.0	98	127
29	9.6	11	4.0	.5	42	24	4.0	.0	2.0	73
30	14	11	....	.1	94	24	4.0	.0	2.0	70
31	11	11	....	.3	....	24	....	.0	21	....

NOTE.—Discharge determined as follows: Dec. 11 to Apr. 1 and Apr. 14 to Aug. 31, from rating table Apr. 2-13 and Sept. 1-30, by indirect method for shifting control. Determination of discharge Sept. 25 obtained from extension of rating curve and possibly subject to considerable error.

Monthly discharge of Colorado River at Ballinger, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 11-31	31	9.6	16.6	691
January	18	9.6	12.0	738
February	11	4.0	10.0	575
March	4	.1	2.87	176
April	1,140	21	204	12,100
May	601	23	77.5	4,770
June	26	3.6	9.19	547
July	4	.0	.19	12
August	98	.0	7.13	438
September	5,500	.0	256	15,200
The period	....	....	....	35,300

COLORADO RIVER NEAR CHADWICK, TEX.

Location.—At the Gulf, Colorado & Santa Fe Railway bridge half a mile below Chadwick dam, 1 mile above mouth of Elliott Creek, 2 miles west of Chadwick, on county line between San Saba and Lampasas counties, and 2½ miles below mouth of San Saba River.

Drainage area.—26,400 square miles.

Records available.—October 21, 1915, to September 30, 1916.

Gage.—Inclined staff, in three sections, attached to rock ledge on left bank about 75 feet upstream from railroad bridge; read by A. G. Walker. A high-water section is painted on left face of left bridge pier. A vertical staff on right bank directly opposite inclined gage is used during low water.

Discharge measurements.—Made from cable 400 feet below gage.

Channel and control.—Bed composed of rock and gravel; not likely to shift. Channel straight above and below station for 1,000 feet. Left bank high, rocky, wooded, and not subject to overflow; right bank medium in height, wooded, composed of clay and gravel, and subject to overflow during extreme stages. Position of control not known, but current-meter measurements indicate that it is practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 15.0 feet at 7 a. m. May 2 (discharge, 16,900 second-feet; result obtained from extension of rating curve and possibly subject to considerable error); minimum stage, 0.66 foot at 8 a. m. August 27 and 28 (discharge 30 second-feet).

Ice.—None reported during year.

Diversions.—No large irrigation works have been completed in drainage basin above station, but tracts ranging in size from 5 to 1,500 acres, adjacent to the main river and tributaries, are irrigated by diversion. A large part of the irrigated area is in Runnels, Brown, and Mills counties and along Concho and San Saba rivers. Several small dams have been constructed in the drainage basin above station. Chadwick dam, half a mile above, creates a small pond and serves only to divert to a water wheel that has not been operated for some time.

Regulation.—Flow not regulated by dams or reservoirs.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 80 and 4,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Results good below 4,000 second-feet; above 4,000 second-feet may be subject to error due to lack of current-meter measurements.

Discharge measurements of Colorado River near Chadwick, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 5	R. C. Pierce	1.45	203	May 6	R. C. Thaxton	3.52	1,100
Feb. 15	R. C. Thaxton	1.44	212	June 13	R. J. Hank	.98	83
Apr. 29	Hank and Gray	1.55	239	Sept. 4	William Kessler	4.54	1,800
May 4	R. C. Thaxton	6.20	3,160	4	.....do	4.93	1,960
4	.....do	5.64	2,530	5	.....do	3.57	1,020
5	.....do	4.55	1,660	7	R. J. Hank	1.94	381
5	.....do	4.20	1,430	28	Victor Lieb	3.45	1,000

Daily discharge, in second-feet, of Colorado River near Chadwick, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	320	190	248	378	155	750	750	290	34	48	166
2	......	308	196	255	262	148	2,600	15,000	160	48	51	160
3	......	290	199	255	255	140	4,190	10,600	160	47	51	130
4	......	238	202	248	248	135	2,600	3,580	135	45	53	785
5	......	283	196	238	244	135	1,150	1,550	130	42	55	1,040
6	......	318	202	230	244	135	1,050	1,050	122	40	55	660
7	......	272	3,220	230	238	130	1,300	825	110	38	48	388
8	......	255	1,380	230	227	128	8,230	668	110	38	45	297
9	......	262	482	230	220	122	1,690	580	110	42	40	190
10	......	255	388	230	220	122	1,300	430	105	42	40	172
11	......	255	342	220	211	122	1,080	395	90	42	40	160
12	......	244	300	220	211	122	800	367	85	45	40	155
13	......	255	290	220	211	122	465	325	81	45	40	430
14	......	262	283	214	205	115	395	325	69	42	42	465
15	......	248	283	205	205	115	1,900	308	69	42	42	500
16	......	238	290	205	205	115	520	290	1,250	34	40	430
17	......	227	290	205	199	115	412	290	850	31	40	325
18	......	220	283	205	196	115	1,150	262	367	31	37	318
19	......	214	255	205	190	115	423	2,060	220	37	35	248
20	......	205	255	205	190	115	402	1,050	190	41	34	184
21	3,140	196	255	1,680	184	115	395	2,140	190	45	34	135
22	1,800	205	255	1,620	184	115	360	1,050	145	48	34	120
23	1,120	214	255	800	181	115	342	482	110	45	33	115
24	825	205	262	465	175	115	325	395	81	45	34	110
25	412	205	285	370	175	130	325	395	77	44	34	110
26	520	199	238	336	166	130	318	332	65	45	31	860
27	493	196	227	290	160	122	318	255	56	48	30	5,670
28	402	196	227	272	160	115	255	205	53	51	30	1,000
29	378	196	227	255	155	115	238	1,050	48	51	32	720
30	360	205	230	248	......	116	220	600	41	51	32	395
31	332	......	248	465	......	110	......	395	......	48	33	......

Monthly discharge of Colorado River near Chadwick, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 21-31	3,140	332	889	19,400
November	320	196	240	14,300
December	3,220	190	394	24,209
January	1,680	205	364	22,400
February	378	155	210	12,100
March	155	110	123	7,560
April	8,230	220	1,180	70,200
May	15,000	205	1,550	95,300
June	1,250	41	186	11,100
July	51	31	42.8	2,630
August	55	30	39.9	2,450
September	5,670	110	538	32,000
The year				314,000

COLORADO RIVER AT AUSTIN, TEX.

Location.—At the Congress Avenue concrete viaduct in Austin, Travis County, half a mile below Shoal Creek and above mouth of Waller Creek 3½ miles below Austin dam.

Drainage area.—34,200 square miles (revised).

Records available.—February 15, 1898, to December 31, 1911; October 1, 1914, to September 30, 1916; September 1, 1895, to April 7, 1900, at Austin Dam. Records of stage have been obtained by United States Weather Bureau since July 1, 1903.

Gage.—Dexter water-stage recorder, installed June 18, 1915, at left end of concrete viaduct. Record of depth of water on crest of dam 3½ miles above Austin was kept from September 1, 1895, to April 7, 1900. Gage used February 15, 1898, to December 31, 1911, was a vertical gage attached to bathhouse on left bank 150 feet above Congress Avenue Bridge; during this period high-stage readings were made by means of a staff gage painted on first pier from left end of bridge and a chain gage attached to bridge. All gages at or near the bridge have been referred to the same datum.

Discharge measurements.—Made by wading or from upstream side of Montopolis highway bridge, 4 miles downstream.

Channel and control.—Channel straight for 1,000 feet above and 500 feet below station. Right bank of medium height, composed of clay and gravel, clean, improved by city, and not subject to overflow; left bank resembles right bank except that it is high and nearly vertical in places. Bed composed of rock and gravel, clean; shifts. Control is a gravel and rock shoal 500 feet below gage; changes during high water and also during low water because of the removal of sand for municipal use.

Extremes of discharge.—Maximum stage recorded during year, 13.1 feet at 4 a. m., May 22 (discharge, 46,000 second-feet); minimum stage, 0.30 foot at 7 a. m., September 21 (discharge, 80 second-feet).

1898–1911; 1914–1916: Maximum stage recorded, 33.5 feet April 7, 1900 (discharge, 122,000 second-feet); minimum stage, −0.50 foot December 13–17, 1914 (discharge, 2 second-feet).

Ice.—None reported during year.

Diversions.—The first report of the Board of Water Engineers for the State of Texas shows that approximately 35,000 acres of land were declared irrigated by diversions from Colorado River above station. The report also shows a filing by the city of Austin, for municipal uses, of 4,000 acre-feet per annum, with a storage of 30,000 acre-feet, 144 acre-feet per annum for Winchell waterworks, 60,000 acre-feet per annum for power from two reservoirs in Burnet County, and an unknown amount for Marble Falls waterworks, all above station. Much of the area irrigated is in the upper basin of the main stream and adjacent to large tributaries.

Regulation.—Flow entirely regulated by operations at the Austin Dam, about 3½ miles upstream.

Accuracy.—Stage-discharge relation not permanent. Numerous discharge measurements are necessary to determine changes in stage-discharge relation. Standard rating curve is well defined below 40,000 second-feet. Error in determinations of mean daily discharge due to regulation of flow eliminated by use of a water-stage recorder. Mean daily gage heights, to half-tenths, obtained by inspecting the recorder graph, or, for days of considerable fluctuation, by averaging hourly gage heights. Daily discharge ascertained by indirect method for shifting control. Results good.

Discharge measurements of Colorado River at Austin, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	R. C. Pierce	0.67	105	May 4	Gray and Hank	5.32	11,700
29	R. C. Thaxton	.67	124	16	Hank and Thaxton	1.58	814
Nov. 9	Thaxton and Pierce	1.55	640	22	Gray and Kessler	9.87	30,200
19	R. J. Hank	1.55	609	June 2	Hank and Thaxton	1.78	1,030
Dec. 1	Hank and Thaxton	1.45	562	12	Kessler and Thaxton	1.20	463
18	Gray and Thaxton	1.60	721	29	Hank and Thaxton	.83	254
Jan. 7	Gray and Hank	1.53	636	July 3	R. J. Hank	.73	200
26	Thaxton and Pierce	2.18	1,640	14	William Kessler	1.45	719
Feb. 16	Gray and Hank	1.56	597	22	Kessler and Lieb	1.73	1,130
Mar. 1	Hank and Kessler	1.44	481	Aug. 4	R. J. Hank	.97	346
15	R. J. Hank	1.19	365	19	Hank and Lieb	1.30	640
Apr. 16	Gray, Hank, and Kessler.	6.50	14,500	28	R. C. Thaxton	.98	368
				29	do	.92	337
17	Thaxton, Hank, and Kessler.	3.92	7,110	31	R. J. Hank	.75	238
				Sept. 2	William Kessler	.65	190
27	Thaxton and Kessler	1.68	1,020	7	do	.52	141
				30	Victor Lieb	.95	340

Daily discharge, in second-feet, of Colorado River at Austin, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,980	810	520	700	870	488	7,000	1,060	1,070	225	394	189
2	3,520	774	480	700	810	466	13,800	1,220	992	202	368	170
3	3,520	774	480	650	858	431	4,680	8,560	992	202	368	152
4	3,390	720	480	605	1,000	445	4,840	12,600	921	202	400	152
5	2,980	720	520	650	926	410	5,920	9,480	869	202	368	120
6	2,900	690	1,010	650	858	424	4,260	6,080	753	202	335	138
7	2,770	690	4,060	650	798	459	3,000	3,420	654	202	335	138
8	2,630	641	3,790	605	740	424	2,300	2,440	610	202	368	173
9	2,500	641	4,470	605	740	424	2,300	1,910	574	335	374	945
10	2,360	596	3,250	560	632	403	5,610	1,590	484	1,230	374	696
11	2,420	596	2,040	605	632	368	3,700	1,380	448	975	374	460
12	2,290	641	1,470	650	632	334	2,580	1,200	457	975	342	354
13	2,010	578	1,300	560	632	410	1,910	1,040	465	780	348	194
14	480	623	1,120	520	632	410	1,470	960	438	720	348	173
15	115	623	968	520	587	375	1,690	830	438	720	380	173
16	100	623	834	480	587	310	12,900	830	400	720	380	173
17	100	623	774	480	587	340	7,000	830	400	720	324	173
18	115	605	720	445	632	310	3,560	1,040	438	840	500	194
19	115	605	670	445	587	310	2,240	1,290	475	1,140	460	173
20	115	650	720	560	587	310	2,240	1,470	660	1,140	500	173
21	115	650	578	650	623	340	1,870	9,330	1,050	1,410	590	80
22	115	520	536	650	578	310	1,710	28,200	780	1,140	500	173
23	375	520	578	884	578	280	1,490	7,160	438	1,050	816	313
24	1,350	520	623	1,280	536	280	1,220	4,540	475	1,050	816	313
25	1,450	578	623	1,470	536	280	1,220	4,400	438	975	696	313
26	1,660	496	660	1,680	488	250	1,140	3,000	368	975	318	313
27	560	496	614	1,430	488	250	1,060	2,160	308	900	264	313
28	154	496	488	1,240	488	250	908	1,690	252	840	348	313
29	134	496	452	1,070	488	250	908	1,470	252	620	387	341
30	118	520	528	898		250	843	1,340	225	415	296	341
31	560		614	898		250		1,170		422	212	

Monthly discharge of Colorado River at Austin, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,520	100	1,420	87,300
November	810	496	617	36,700
December	4,470	452	1,160	71,300
January	1,680	445	767	47,200
February	1,000	488	660	38,000
March	488	250	350	21,500
April	13,800	843	3,510	209,000
May	28,200	830	3,990	245,000
June	1,070	225	571	34,000
July	1,410	202	701	43,100
August	816	212	416	25,600
September	945	80	264	15,700
The year	28,200	80	1,200	874,000

Days of deficiency in discharge of Colorado River at Austin, Tex., for the years ending Sept. 30, 1902–1910 and 1915–16.

Discharge in second-feet.	1901–2	Days of deficient discharge.									
		1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10	1914–15	1915–16
100	......	......	......	......	......	45	......	......	36	26	3
200	1	......	3	20	45	103	1	34	55	44	29
300	20	10	22	75	135	204	11	94	102	68	52
400	68	30	130	150	185	228	41	156	165	72	97
500	167	59	189	177	198	253	78	195	228	83	145
600	216	77	223	196	207	261	92	203	241	95	177
700	236	90	243	218	221	292	142	226	266	112	222
800	251	108	259	234	224	300	166	234	279	120	239
900	263	122	266	242	251	305	179	244	281	135	257
1,000	271	148	273	247	234	310	190	250	294	142	272
1,200	284	197	286	263	241	315	225	273	307	205	289
1,400	292	218	292	273	247	323	256	293	319	240	300
1,600	301	232	300	282	255	327	261	299	321	255	310
1,800	313	247	305	291	263	331	271	310	321	262	315
2,000	317	260	309	296	267	334	276	317	322	262	318
3,000	330	307	322	315	291	342	299	332	335	289	338
4,000	338	321	332	327	301	345	317	342	338	307	346
5,000	341	331	337	334	314	347	322	347	341	314	353
6,000	343	340	342	339	320	348	329	349	343	324	355
7,000	344	344	346	342	323	348	331	352	345	338	358
8,000	347	346	348	345	325	348	336	354	350	347	359
9,000	349	350	350	347	330	348	340	355	352	348	360
10,000	353	351	352	348	335	352	344	356	344	349	362
20,000	356	360	359	359	350	363	351	362	364	355	365
30,000	361	362	364	363	359	365	357	365	365	367	366
40,000	365	365	365	364	362	......	361	......	......	362	......
50,000	......	......	366	364	362	......	362	......	......	362	......
60,000	......	......	......	365	364	......	364	......	......	363	......
75,000	......	......	......	......	365	......	366	......	......	364	......
100,000	......	......	......	......	......	......	......	......	......	365	......

EVAPORATION NEAR AUSTIN, TEX.

Location.—At reservoir on Hill's ranch, about 1,000 feet from ranch house, 5 miles south of Austin, Travis County. Elevation 475 feet above sea level.

Records available.—April to September, 1916.

Equipment.—Two evaporation pans, one floating on surface of reservoir and the other on land about 30 feet from reservoir; auxiliary equipment consists of hook gages, rain gage, anemometer, maximum and minimum thermometers, and psychrometer.

Evaporation near Austin, Tex., for the period April to September, 1916.

Month.	Temperature.					Mean relative humidity.
	Air.			Water.		
	Mean maximum.	Mean minimum.	Mean.	Floating pan (mean).	Land pan (mean).	
	°F.	*°F.*	*°F.*	*°F.*	*°F.*	*Per cent.*
April	78.7	54.5	66.6	65.9	59.2	80.5
May	[a] 85.4	63.7	[b] 74.6	73.9	69.9	81.0
June	94.7	71.7	83.2	80.0	77.1	73.7
July	94.8	71.8	83.3	82.0	77.8	77.2
August	93.4	70.4	81.9	80.4	76.3	78.7
September	90.3	64.1	77.2	75.9	70.9	77.6

Month.	Wind.		Rainfall.	Evaporation.	
	Average miles per hour.	Prevailing direction.		Floating pan.	Land pan.
			Inches.	*Inches.*	*Inches.*
April	3.7	South	3.54	[c] 4.76	[c] 6.88
May	2.5	do	8.05	[d] 6.13	[c] 8.09
June	1.1	do	.71	7.74	8.53
July	1.2	do	2.97	6.50	7.76
August	1.0	do	1.29	5.59	7.46
September	1.2	do	2.94	5.00	6.84

[a] Mean for 27 days. [b] Mean for 29 days. [c] Total for 29 days. [d] Total for 28 days.

COLORADO RIVER AT COLUMBUS, TEX.

Location.—At county highway bridge half a block from county jail, 400 feet below Galveston, Harrisburg & San Antonio Railway bridge in eastern edge of Columbus, Colorado County.

Drainage area.—37,000 square miles (revised).

Records available.—August 2, 1902, to December 31, 1911; May 22, 1916, to September 30, 1916. Records of stage have been obtained by the United States Weather Bureau since January 1, 1903.

Gage.—Mott tape-and-weight gage, property of the United States Weather Bureau, installed December 17, 1907, on downstream handrail of bridge; read by W. E. Bridge. From August 2, 1902, to December 16, 1907, gage heights were obtained by measuring with a tagged chain and lead weight from point on top of bridge pier to water surface.

Discharge measurements.—Made from upstream side of bridge, or by wading.

Channel and control.—Channel straight above and below station for 400 feet. Right bank composed of firm earth; high and not subject to overflow; left bank of medium height; overflow likely. Bed of stream clean and sandy; shifts during high stages. A sand and gravel section about 350 feet below gage serves as low-water control, but the stage-discharge relation during medium and high stages may be controlled by a bend in river below bridge.

Extremes of discharge.—Maximum stage recorded during year, 24.7 feet from 9.50 a. m. to 2.30 p. m. May 23 (discharge, 36,800 second-feet); minimum stage, 6.38 feet at 7 a. m. and 6 p. m. September 25 (discharge, 278 second-feet).

1902–1911; 1916: Maximum stage recorded, 35.8 feet April 27, 1908 (discharge, 43,100 second-feet); minimum stage, 4.2 feet September 9 and 10, 1910 (discharge, 10 second-feet).

Ice.—None reported during year.

Diversions.—Considerable water is diverted for irrigation in the drainage basin above Austin, but between Austin and Columbus little water is pumped or diverted by gravity. The station is above the irrigated rice belt, which comprises several thousand acres. Filings have been made with the Board of Water Engineers for the State of Texas for continuous use of water for Smithville, Bastrop, and La Grange waterworks, all above station.

Regulation.—Flow at Columbus during ordinary stages controlled by storage at Lake Austin.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined below 45,000 second-feet. Gage read to hundredths twice a day. Mean of two readings may not be a true index of daily discharge because of regulation above station. Daily discharge ascertained by applying mean daily gage heights to rating table except for periods during which stage-discharge relation is affected by shifting control. Results good.

Cooperation.—Morning gage readings furnished by United States Weather Bureau.

Discharge measurements of Colorado River at Columbus, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 22	R. C. Thaxton	20.92	30,600	June 30	R. C. Thaxton	6.88	596
23	do	24.70	36,600	July 10	do	6.83	566
23	do	24.25	35,700	27	do	8.24	1,370
24	do	18.05	16,206	Aug. 12	do	7.03	625
24	do	16.63	11,900	Sept. 6	Victor Lieb	6.60	481
25	do	14.29	7,840	6	do	6.60	417
June 17	do	7.19	788				

Daily discharge, in second-feet, of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1		1,890	565	1,230	590	16		735	1,090	520	565
		1,670	520	962	595	17		760	950	510	505
		1,490	836	785	535	18		735	878	505	440
4		1,400	920	710	505	19		745	884	515	364
		1,340	590	650	475	20		765	878	505	337
		1,340	550	665	440	21		770	866	560	324
		1,340	500	950	420	22	18,200	932	1,050	785	319
		1,220	480	725	405	23	33,400	685	1,550	790	306
		1,160	510	645	382	24	15,600	812	2,240	770	301
		1,040	545	580	355	25	7,300	1,010	1,590	760	278
		920	580	555	355	26	4,830	932	1,440	780	296
		830	690	610	373	27	3,820	685	1,380	968	324
		812	780	535	646	28	3,070	650	1,340	830	373
		785	1,230	520	755	29	2,750	640	1,560	795	373
		735	1,090	520	685	30	2,380	600	1,510	715	368
						31	2,200		1,290	660	

NOTE.—Discharge determined as follows: May 22 to June 5, June 25 to Aug. 1, and Sept. 4–12, from rating table; June 6–24, Aug. 2 to Sept. 3, and Sept. 13–30, by indirect method for shifting control.

Monthly discharge of Colorado River at Columbus, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 22-31	33,400	2,200	9,380	186,000
June	1,890	600	981	58,400
July	2,240	480	996	61,200
August	1,230	505	697	42,800
September	755	278	433	25,800
The period				374,600

NORTH CONCHO RIVER AT SAN ANGELO, TEX.

Location.—At the county concrete viaduct in San Angelo, Tom Green County, a mile above confluence of North Concho and South Concho rivers.

Drainage area.—7,530 square miles.

Records available.—October 27, 1915, to September 30, 1916.

Gage.—Vertical staff attached to web of third pier of viaduct from left bank; read by H. M. Garden and L. E. Gage.

Discharge measurements.—Made by wading 400 feet below viaduct.

Channel and control.—Bed composed of solid rock which is to some extent covered in high-water channel with grass and moss; permanent. Channel straight for 800 feet above and 400 feet below gage. Banks are sloping, clean, composed of rock and clay, and not subject to overflow except during high floods. About 20 feet below gage and at downstream side of viaduct is a concrete dam 4½ feet high, which, before the viaduct was constructed, served as part of a low-water crossing; this dam forms an artificial control and insures a permanent stage-discharge relation.

Extremes of discharge.—Maximum stage recorded during year, 1.92 feet at 5.25 p. m. April 14 (discharge, 465 second-feet; result obtained from extension of rating curve and possibly subject to some error); no flow June 5–14 and June 22 to September 30.

Ice.—None reported during year.

Diversions.—According to First Report of the Board of Water Engineers for the State of Texas some water is diverted; amount diverted above station not known.

Regulation.—Flow not regulated by water-power plants or reservoirs.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined below but possibly subject to error above 200 second-feet. Gage read to hundredths daily; oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Results good.

Discharge measurements of North Concho River at San Angelo, Tex., for the period Sept. 16, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 16	Hank and Thaxton	[a]1.19	117	Feb. 11	R. J. Hank	0.83	12.1
17	.....do	[a]1.00	45.4	Mar. 28	.....do	.78	8.0
18	.....do	[a].88	18.9	Apr. 27	Gray and Hank	.85	13.5
Oct. 27	R. J. Hank	.73	6.8	June 20	R. J. Hank	.38	.5
Dec. 17	.....do	.79	8.6	Aug. 29	William Kessler		.0
				Sept. 5	R. J. Hank		.0
				30	.....do		.0

[a] Gage heights refer to temporary gage above viaduct and within influence of backwater from dam which serves as artificial control.

Daily discharge, in second-feet, of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		6.4	6.4	6.4	11	14	62	19	0.7
2		6.4	6.4	6.4	11	14	22	17	.6
3		6.4	6.4	6.4	11	14	20	17	.5
4		6.4	6.4	6.4	11	14	19	17	.3
5		6.4	6.4	6.4	11	14	19	19	.0
6		6.4	6.4	6.4	11	14	17	17	.0
7		6.4	6.4	6.4	11	14	16	17	.0
8		6.4	6.4	6.4	12	14	16	16	.0
9		6.4	6.4	6.4	12	14	14	14	.0
10		6.4	6.6	6.4	13	14	14	13	.0
11		6.4	6.8	6.4	14	14	14	12	.0
12		6.4	7.3	6.4	14	14	14	12	.0
13		6.4	8.2	6.4	14	14	14	12	.0
14		6.4	9.2	6.4	14	14	455	12	.0
15		6.4	6.8	6.4	14	14	180	12	19
16		6.4	6.4	6.4	14	14	45	12	6.8
17		6.4	7.3	6.4	14	14	30	12	2.1
18		6.4	6.4	6.4	14	14	22	12	1.1
19		6.4	6.4	6.4	14	14	19	12	.7
20		6.4	6.4	6.4	14	14	16	11	.5
21		6.4	6.4	6.4	14	14	14	9.2	.2
22		6.4	6.4	6.4	14	14	14	8.2	.0
23		6.4	6.4	6.4	14	14	14	7.8	.0
24		6.4	6.4	9.2	14	14	14	6.4	.0
25		6.4	6.4	14	14	14	13	5.8	.0
26		6.4	6.4	17	14	12	13	5.0	.0
27	6.4	6.4	6.4	14	14	10	14	4.4	.0
28	6.4	6.4	6.4	12	14	9.2	16	3.6	.0
29	6.4	6.4	6.4	11	14	9.2	16	3.0	.0
30	6.4	6.4	6.4	11		8.7	16	2.4	.0
31	6.4		6.4	11		8.7		1.8	

NOTE.—No flow June 5-14 and June 22 to Sept. 30. Discharge interpolated because of missing gage heights Dec. 10-12, 20-26, Jan. 8, 9, Feb. 6, 13, 14, 20, 27, Mar. 5, 12, 26, and 27.

Monthly discharge of North Concho River at San Angelo, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 27-31	6.4	6.4	6.40	63
November	6.4	6.4	6.40	381
December	9.2	6.4	6.64	408
January	17	6.4	7.95	489
February	14	11	13.1	754
March	14	8.7	13.2	812
April	455	13	39.1	2,330
May	19	1.8	11.1	682
June	19	.0	1.08	64
July	.0	.0	.00	0
August	.0	.0	.00	0
September	.0	.0	.00	0
The period				5,980

CONCHO RIVER NEAR SAN ANGELO, TEX.

Location.—Half a mile below confluence of North Concho and South Concho rivers, 1¾ miles southeast of San Angelo, Tom Green County.

Drainage area.—10,800 square miles.

Records available.—September 17, 1915, to September 30, 1916.

Gage.—Vertical staff in several sections attached to trees on left bank about 1,500 feet below an old ford; read by Mrs. B. H. Cummins.

Discharge measurements.—Made by wading or from cable 80 feet below gage.

Channel and control.—Bed composed of solid rock and gravel. Channel straight for 1,000 feet above and below station. Right bank high, rocky, wooded, and not subject to overflow; left bank of medium height, composed of clay and gravel, covered with scattering trees, and subject to overflow at high stages. Rapids about 100 feet below the gage serve as control for medium and low stages; do not shift; position of control for high stages not known.

Extremes of discharge.—1915–16: Maximum stage recorded, 13.5 feet during the night of September 24, 1915 (discharge not determined); minimum stage, 0.50 foot at 11 a. m. June 24, 1916 (discharge, 2.3 second-feet).

Ice.—None reported during year.

Diversions.—Considerable water is diverted above station, and pumping plants are immediately below. First Report of the Board of Water Engineers for the State of Texas shows a total of 25,000 acre-feet per annum is taken from the stream. About a mile above mouth of South Concho River a storage dam has been constructed by the San Angelo Light & Power Co. for waterworks, but as the capacity of the reservoir is small and the height of the dam constant, a large part of the natural flow of the stream that enters the reservoir will join the water of the North Concho at confluence of the two streams.

Regulation.—Storage at the dam of the San Angelo Light & Power Co. has slight effect on flow at station; no regulation by storage on North Concho River.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined below 250 second-feet. Gage read to hundredths once daily. One reading daily may not be a true index of the mean daily discharge because of regulation and rapid fluctuation during floods. Daily discharge ascertained by applying daily gage heights to rating table. Results are good during medium stages, fair during extreme low stages, and poor during high stages; determinations of discharge above 400 second-feet may be considerably in error.

Discharge measurements of Concho River near San Angelo, Tex., for the period Sept. 17, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 17	Hank and Thaxton	2.00	166	Mar. 28	R. J. Hank	1.46	46.5
Oct. 27	R. J. Hank	1.76	107	Apr. 27	Gray and Hank	1.59	58
Dec. 16	.....do	1.60	84	June 20	R. J. Hank	.55	3.3
				Aug. 29	William Kessler	.57	3.5
1916.				Sept. 4	R. J. Hank	1.60	73
Feb. 11	.....do	1.68	80	29	.....do	1.10	22.9

Daily discharge, in second-feet, of Concho River near San Angelo, Tex., for the period Sept. 17, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		126	83	72	85	88	34	114	64	6.8	4.3	4.9	626
2		126	83	77	85	85	36	146	88	6.3	3.5	4.7	1,750
3		126	81	77	83	88	36	126	74	5.9	3.3	4.5	126
4		126	76	76	98	90	43	114	76	5.3	4.3	4.7	68
5		120	85	83	95	88	51	108	72	3.7	6.1	4.7	45
6		111	81	108	85	85	41	108	72	4.1	4.3	4.5	39
7		120	83	108	81	83	35	111	51	4.1	4.3	4.3	36
8		111	88	106	85	88	35	85	58	5.3	4.1	4.5	30
9		106	83	98	95	79	40	98	51	10	3.7	4.1	32
10		111	76	93	95	83	40	85	46	8.2	4.3	4.3	23
11		106	58	85	95	81	33	88	41	4.1	5.3	4.3	17
12		98	70	85	88	79	47	85	38	8.5	4.3	4.7	30
13		98	70	95	88	79	51	88	30	6.3	4.9	4.3	445
14		106	54	88	95	76	37	870	35	3.9	6.3	3.9	98
15		98	66	85	90	79	24	303	37	7.1	4.3	3.9	51
16		91	70	83	79	79	33	126	30	7.9	3.1	4.1	44
17	171	85	66	83	81	77	39	111	39	5.9	3.3	4.3	47
18	126	373	70	81	83	66	33	98	39	5.5	3.7	3.7	42
19	111	177	74	85	93	52	39	76	39	4.5	4.3	4.7	38
20	90	117	70	90	90	50	41	66	46	3.3	5.7	3.9	34
21	85	111	62	88	88	52	34	60	42	3.7	4.3	3.9	36
22	117	98	76	85	85	48	26	50	37	3.5	4.5	3.9	36
23	111	93	76	85	79	41	43	62	41	3.1	4.1	5.3	45
24	2,200	106	76	81	85	37	35	58	37	2.3	4.9	3.9	41
25	400	98	70	83	90	34	38	51	13	3.5	4.3	4.1	24
26	177	98	64	79	90	41	46	58	14	51	4.1	3.3	23
27	156	98	64	79	90	45	31	66	12	11	4.5	3.5	23
28	140	95	68	79	88	41	51	72	33	6.1	4.5	3.3	21
29	134	101	76	76	93	41	46	66	24	4.3	4.3	3.5	18
30	134	91	72	77	95		41	68	8.5	5.3	6.1	3.5	21
31		68		79	95		83		7.4		5.3	3.5	

NOTE.—Discharge for Sept. 24, 1915, and Apr. 14, Sept. 1, 2, and 13, 1916, determined from an extension of the rating curve; determinations subject to considerable error.

Monthly discharge of Concho River near San Angelo, Tex., for the period Sept. 17, 1915, to Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
September 17-30	2,200	85	297	8,250
1915-16.				
October	373	68	116	7,130
November	85	54	72.9	4,340
December	108	72	85.5	5,260
January	98	79	88.6	5,450
February	90	34	67.2	3,870
March	83	24	40.1	2,470
April	870	50	120	7,140
May	83	7.4	41.6	2,560
June	51	2.3	7.02	418
July	6.3	3.1	4.46	274
August	5.3	3.3	4.15	255
September	1,750	17	130	7,740
The year	1,750	2.3	64.6	46,900

CONCHO RIVER NEAR PAINT ROCK, TEX.

Location.—At the Concho, San Saba & Llano Valley Railroad bridge a quarter of a mile below mouth of Kickapoo Creek, 2 miles northwest of Paint Rock, Concho County.

Drainage area.—11,800 square miles.

Records available.—September 20, 1915, to September 30, 1916.

Gage.—Vertical staff attached to downstream end of middle railroad bridge pier; read by J. C. Godwin.

Discharge measurements.—Made by wading or from downstream side of bridge.

Channel and control.—Bed composed of solid rock, smooth, clean, free from vegetation, and permanent. Channel straight for 500 feet above and below gage. Right bank 30 feet high, solid rock, clean, and not subject to overflow; left bank of medium height, sloping, wooded, and subject to overflow during high water. Permanent control during low and medium stages at a shoal in solid rock 400 feet below gage.

Extremes of discharge.—1915–16: Maximum stage recorded, 8.6 feet 11.30 a. m. September 24, 1915 (discharge not computed); no flow July 4 to September 1, 1916.

Ice.—None reported during year.

Diversions.—Station is above a large part of the irrigable area in the vicinity of Paint Rock, but considerable water is diverted from the stream in that part of the basin above San Angelo; quantity of water diverted between San Angelo and this station not known but probably small.

Regulation.—None apparent. There is one dam, known to be abandoned, in the stretch of river between San Angelo and the station, and possibly additional dams exist, but none of them appreciably affect the flow.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined below 250 second-feet; determinations above 250 second-feet possibly subject to error. Gage read to hundredths once daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Results good.

Discharge measurements of Concho River near Paint Rock, Tex., for the period Sept. 20, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 20	Hank and Thaxton	1.85	123	Feb. 18	R. J. Hank	1.65	71
Oct. 25	R. J. Hank	1.78	101	Mar. 29	.....do	1.46	33.5
Dec. 12	.....do	1.73	83	Apr. 26	Gray and Hank	1.54	54
				June 17	R. J. Hank	.75	.8
				Aug. 30	William Kessler	....	.0
				Sept. 6	R. J. Hank	1.60	62

Daily discharge, in second-feet, of Concho River near Paint Rock, Tex., for the period Sept. 20, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		120	108	80	84	84	38	246	62	14	0.8	0.0	0
2		120	103	80	89	84	38	246	66	12	.4	.0	1,350
3		120	96	84	89	84	38	186	62	11	.1	.0	438
4		120	96	84	89	80	34	132	62	10	.0	.0	158
5		120	96	84	96	80	34	132	52	9.0	.0	.0	108
6		113	96	132	94	80	34	132	45	6.9	.0	.0	62
7		108	96	153	84	80	34	127	41	6.5	.0	.0	41
8		103	89	153	84	80	29	127	41	5.1	.0	.0	26
9		108	84	145	84	80	29	120	38	5.1	.0	.0	21
10		103	84	145	84	80	26	108	38	4.4	.0	.0	18
11		103	84	137	84	80	26	96	34	3.8	.0	.0	52
12		96	84	94	84	66	26	89	26	3.2	.0	.0	108
13		96	84	96	84	73	24	84	24	3.0	.0	.0	158
14		96	84	96	84	73	24	84	21	2.7	.0	.0	278
15		96	80	89	84	73	24	326	21	2.2	.0	.0	127
16		96	80	89	84	66	24	158	21	1.5	.0	.0	84
17		96	73	89	84	66	21	132	24	.8	.0	.0	62
18		108	73	84	84	66	21	108	34	.4	.0	.0	52
19		374	73	84	80	66	21	96	29	16	.0	.0	45
20	120	186	73	84	80	66	21	89	26	11	.0	.0	45
21	96	145	73	84	80	62	18	80	26	6.9	.0	.0	41
22	96	108	73	84	80	58	16	73	24	5.8	.0	.0	41
23	96	103	73	84	80	52	18	66	24	4.7	.0	.0	38
24	1.810	103	73	80	73	45	21	62	24	3.8	.0	.0	34
25	848	108	73	80	80	43	24	52	24	3.0	.0	.0	108
26	294	108	80	80	84	41	26	45	24	2.7	.0	.0	52
27	186	103	80	80	80	41	26	45	21	2.2	.0	.0	38
28	172	103	80	80	80	38	26	41	21	1.8	.0	.0	29
29	153	108	80	80	80	34	29	41	18	1.5	.0	.0	24
30	132	103	80	80	96		35	41	16	1.3	.0	.0	18
31		103		84	89		41		15		.0		

NOTE.—Mean gage height Sept. 24, 1915, 6.60 feet; discharge determined from extension of rating curve; result possibly subject to considerable error.

Monthly discharge of Concho River near Paint Rock, Tex., for the period Sept. 20, 1915, to Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
September 20–30	1,810	96	364	7,940
1915–16.				
October	374	96	118	7,260
November	108	73	83.2	4,950
December	153	80	96.1	5,910
January	96	73	84.2	5,180
February	84	34	66.2	3.810
March	41	16	27.3	1,680
April	326	41	112	6,660
May	66	15	32.4	1,990
June	16	.4	5.31	316
July	.8	.0	.04	2
August	.0	.0	.00	0
September	1,350	.0	122	7,260
The year	1,350	.0	62.0	45,000

SAN SABA RIVER AT MENARD, TEX.

LOCATION.—At steel highway bridge in Menard, Menard County, about 80 miles above mouth of stream.

DRAINAGE AREA.—1,140 square miles.

RECORDS AVAILABLE.—September 14, 1915, to September 30, 1916.

Gage.—Chain gage attached to floor on downstream side of highway bridge; read by Henry Patton.

Discharge measurements.—Made by wading or from downstream side of bridge.

Channel and control.—Channel straight 800 feet above and 100 feet below station; water flows through a series of shoals and ponds; channel above gage somewhat obstructed by reeds and grass, but below the gage it is clean and the flow is unobstructed. Right bank composed of gravel and clay, wooded, sloping, high, and not subject to overflow; left bank similar in material, wooded, low, and subject to overflow during high stages. A sand and gravel ford just below gage forms a practically permanent control during low and medium stages, but shifts at extremely high stages.

Extremes of discharge.—Maximum stage recorded during year, 3 feet at 9 a. m. April 1 (discharge, 195 second-feet; result obtained by extension of rating curve and possibly subject to considerable error); minimum stage recorded, 1.76 feet at 6 p. m. August 16 and 4.20 p. m. August 17 (discharge, 6.8 second-feet), obtained by extension of rating curve; determinations possibly subject to considerable error.

1915–16: Maximum stage recorded, 13.6 feet at 2.30 a. m. September 16, 1915 (discharge not determined); minimum stage August 16 and 17, 1916 (see preceding paragraph).

Ice.—None reported during year.

Diversions.—Considerable land is irrigated with water diverted or pumped above station. Noyes canal, on right side of river, carries water that is diverted a short distance above gage. Several pumping plants are above and below gage. The First Report of the Board of Water Engineers for the State of Texas shows that approximately 2,400 acres are declared irrigated above the station by 4,800 acre-feet of water per annum.

Regulation.—Flow unregulated by storage or water-power plants.

Accuracy.—Stage-discharge relation practically permanent during low and medium stages, but changes during high water. Rating curve well defined between 10 and 100 second-feet. Determinations of discharge above 100 second-feet may be subject to considerable error. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Results excellent except for extreme stages, for which they may be considerably in error.

Discharge measurements of San Saba River at Menard, Tex., for the period Sept. 14, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 14	R. C. Thaxton	2.10	38.1	Feb. 17	R. C. Thaxton	2.17	37.5
Oct. 24	R. C. Pierce	2.37	62.1	Apr. 25	Hank and Gray	2.23	38.1
Dec. 7	.....do	2.25	50.4	June 16	R. J. Hank	2.05	19.4
				Sept. 19	Victor Lieb	2.14	36.6
				20	.....do	2.15	36.5

Discharge measurements of Noyes canal[a] at Menard, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 17	R. C. Thaxton		9.7	June 16	R. J. Hank		12.0
Apr. 25	Hank and Gray		10.8				

[a] See description of San Saba River at Menard, Tex.

Daily discharge, in second-feet, of San Saba River at Menard, Tex., for the period Sept. 14, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		78	60	34	37	37	43	113	113	28	20	23	15
2		78	62	32	37	37	41	87	84	22	14	19	16
3		73	62	32	37	37	37	59	84	23	13	16	17
4		70	59	32	37	37	37	67	78	22	11	19	15
5		70	60	32	37	37	46	67	78	22	9.6	19	14
6		70	60	47	37	37	46	73	73	22	10	18	13
7		70	60	43	37	36	48	70	77	18	10	17	12
8		70	62	39	35	36	44	64	77	12	11	19	13
9		70	60	36	35	34	48	67	73	14	11	30	13
10		70	60	34	35	35	51	70	73	14	12	30	13
11		70	53	32	36	35	48	67	73	14	11	22	12
12		70	26	32	35	37	46	67	72	13	10	12	14
13		70	30	34	32	35	40	65	70	11	9.6	11	46
14	39	70	30	36	32	32	46	70	65	9.6	9.2	9.2	43
15		70	30	37	35	34	46	70	60	10	10	7.7	39
16		70	30	37	35	35	44	70	62	16	10	7.1	26
17		70	30	37	32	37	47	70	57	21	10	7.1	31
18	250	105	30	37	32	35	73	68	51	22	11	8.4	30
19	129	73	30	37	34	36	78	70	51	21	10	9.2	32
20	84	70	30	37	37	35	80	70	41	20	12	10	32
21	91	70	30	37	43	32	73	51	41	19	22	9.6	32
22	78	70	30	37	39	35	54	40	43	16	14	10	32
23	87	70	30	37	37	35	36	40	40	13	14	12	32
24	87	70	28	37	37	35	35	46	35	12	13	14	32
25	87	67	28	37	35	35	34	44	34	13	14	11	32
26	87	64	30	37	37	35	32	39	32	12	15	12	32
27	87	64	32	37	37	43	27	40	34	12	15	11	32
28	78	60	34	37	37	41	28	40	32	16	14	13	32
29	78	60	31	37	37	41	30	40	32	18	14	14	34
30	78	60	34	37	37		27	40	35	22	27	14	32
31		59		37	37		27		34		44	14	

NOTE.—Mean gage height Sept. 15, 6.35 feet; Sept. 16, 10.61 feet; Sept. 17, 5.58 feet; discharge not determined.

Monthly discharge of San Saba River at Menard, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	105	59	70.0	4,300
November	62	26	41.0	2,440
December	47	32	36.2	2,230
January	43	32	36.0	2,210
February	43	32	36.1	2,080
March	80	27	44.9	2,760
April	113	39	61.5	3,660
May	113	32	58.2	3,580
June	28	9.6	16.9	1,010
July	44	9.2	13.9	855
August	30	7.1	14.5	892
September	46	12	25.6	1,520
The year	113	7.1	37.9	27,500

SAN SABA RIVER NEAR SAN SABA, TEX.

Location.—Two hundred feet above Beveridge highway bridge, a mile below mouth of China Creek, 2 miles northwest of San Saba, San Saba County, 3 miles below mouth of Richland Creek, 4 miles above mouth of Simpson Creek.

Drainage area.—3,000 square miles.

Records available.—December 30, 1904, to December 31, 1906; September 11, 1915, to September 30, 1916. Miscellaneous discharge measurements previous to 1904.

Gage.—Vertical and inclined staff on right bank; read by J. M. Walker. From December 30, 1904, to December 31, 1906, gage heights were obtained by measuring with a tape from a reference point on the bridge to the water surface. Relation between datum used 1904–1906 and that of present gage is not known.

Discharge measurements.—Made by wading or from downstream side of bridge.

Channel and control.—Channel straight above and below station for 100 feet. Bed composed of rock and gravel; shifts only during high floods. Left bank composed of gravel and clay, wooded, high, and not subject to overflow; right bank consists of clay and gravel, wooded, sloping, medium in height, and subject to overflow during high water. A shoal at a ford 75 feet below gage serves as control during medium and low stages; control is free from vegetation and does not shift during low and medium stages.

Extremes of discharge.—Maximum stage recorded during year, 15.7 feet during night of May 1 (discharge not determined); minimum stage, 1.10 feet at times during afternoon of July 5, 12, 13, and 15 (discharge, 20 second-feet).

1904–1906; 1915–16: Maximum stage recorded, 31.7 feet August 7, 1906 (discharge not determined); minimum flow, December 20, 1904, when discharge measurement showed 15 second-feet (gage not read).

Ice.—None reported during year.

Diversions.—Considerable water is diverted or pumped from the stream and tributaries above station. There are also diversions below the station, but none in the vicinity of the station. The First Report of the Board of Water Engineers for the State of Texas shows that 4,360 acres of land were declared irrigated, and that approximately 8,700 acre-feet of water is used each year above station. Flood water from Brady Creek at Brady is stored for municipal uses; capacity of reservoir not known but probably small.

Regulation.—Flow not regulated by dams or reservoirs.

Accuracy.—Stage-discharge relation permanent during low and medium stages. Rating curve well defined between 20 and 300 second-feet; determinations above 300 second-feet possibly subject to considerable error. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Results excellent, except during periods of high water.

Discharge measurements of San Saba River near San Saba, Tex., for the period Sept. 11, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 11	R. J. Hank............	1.75	111	June 12	R. J. Hank............	1.33	37.8
Oct. 20	.....do..............	2.15	194	Sept. 3	William Kessler........	1.28	33.6
23	R. C. Pierce...........	1.99	136	3	.....do..............	1.28	32.2
Dec. 2	R. C. Thaxton..........	1.84	107	28	Victor Lieb............	1.68	85.0
1916.							
Feb. 11	R. C. Thaxton.........	1.82	110				
Apr. 29	Hank and Gray........	1.75	93.8				

Daily discharge, in second-feet, of San Saba River near San Saba, Tex., for the period Sept. 11, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	207	130	112	122	278	94	565	....	70	30	47	33
2	....	194	122	112	120	130	88	870	....	70	36	47	34
3	....	176	130	110	118	122	87	440	1,230	68	31	49	36
4	....	170	122	106	112	122	85	218	395	62	25	54	35
5	....	156	124	112	112	122	85	156	252	67	24	54	31
6	....	156	122	1,200	112	120	85	142	207	55	26	47	32
7	....	156	124	1,420	110	118	82	167	173	55	27	45	34
8	....	142	132	263	102	112	78	156	164	53	29	41	39
9	....	142	130	164	104	112	88	138	142	49	44	36	40
10	....	142	132	148	110	112	94	130	134	40	29	39	39
11	112	142	132	138	112	110	88	122	132	50	29	38	40
12	88	142	132	130	112	110	88	120	124	45	24	37	42
13	82	142	132	122	110	102	82	112	120	37	22	38	128
14	82	142	138	122	106	102	78	118	112	32	24	41	56
15	242	142	132	126	102	102	82	148	112	173	23	43	44
16	....	142	122	126	106	102	83	134	114	73	33	42	42
17	....	142	124	132	110	102	83	122	159	56	28	44	42
18	....	673	124	124	102	102	79	118	194	52	24	44	40
19	....	302	124	122	114	102	78	114	156	48	24	36	46
20	760	194	118	122	122	102	70	104	130	43	26	43	50
21	505	173	102	118	185	100	70	102	126	37	118	41	52
22	350	145	112	118	142	99	82	102	118	38	36	41	49
23	310	138	102	112	126	102	87	99	112	39	54	43	48
24	270	126	102	122	112	95	94	94	104	38	50	39	48
25	270	126	106	112	112	94	92	94	104	41	46	38	278
26	235	122	102	112	112	85	85	95	106	32	50	39	134
27	218	126	104	112	118	85	73	94	88	30	52	41	88
28	200	126	102	112	118	85	72	92	79	26	60	39	82
29	200	122	104	114	118	85	70	92	78	24	56	36	60
30	235	122	106	114	120	....	64	87	72	26	51	36	55
31	....	130	....	120	228	....	67	....	70	....	51	37	....

NOTE.—Discharge not determined Sept. 16-19, 1915, or May 1 and 2, 1916, as gage heights are above limit to which rating curve is defined. Mean gage height Sept. 16, 13.60 feet; Sept. 17, 18.00 feet; Sept. 18, 10.40 feet; Sept. 19, 4.72 feet; May 1, 6.50 feet; May 2, 9.25 feet; maximum stage recorded Sept. 17, 21.6 feet.

Monthly discharge of San Saba River near San Saba, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	673	122	170	10,500
November	138	102	119	7,080
December	1,420	106	202	12,400
January	228	102	120	7,380
February	278	85	111	6,380
March	94	64	81.4	5,010
April	870	87	172	10,200
May 3-31	1,230	70	176	10,100
June	173	24	51.0	3,030
July	118	22	38.1	2,340
August	54	36	41.8	2,570
September	278	31	59.2	3,520

NORTH LLANO RIVER NEAR JUNCTION, TEX.

Location.—About 500 feet above remains of old Wilson dam, 1 mile below mouth of Bear Creek, 2½ miles above North Llano highway bridge, 3 miles northwest of Junction, Kimble County, 4 miles above confluence of North Llano and South Llano rivers.

Drainage area.—803 square miles.

Records available.—September 14, 1915, to September 30, 1916.

Gage.—Overhanging chain gage on left bank; read by J. R. Pettitt.

Discharge measurements.—Made by wading or from highway bridge 2½ miles below station.

Channel and control.—Bed composed of solid rock; clean and permanent. Channel straight above and below for 400 feet, with a series of pools and rapids. Left bank high, clean, and not subject to overflow; right bank low, wooded, and subject to overflow during high stages. One channel at all stages; current sluggish at gage during low and medium stages. A solid rock ledge of approximately 2 feet vertical fall at site of old dam serves as a permanent control for medium and low stages; control clean and free from vegetation.

Extremes of discharge.—Maximum stage recorded during year, 1.75 feet at 6.45 a. m. October 1 (discharge, 117 second-feet); minimum stage, 0.91 foot, at 8 a. m. September 16 (discharge, 1.2 second-feet).

1915–16: Maximum stage recorded, 18.0 feet during night of September 15, 1915 (discharge not determined); minimum stage, September 16, 1916 (see preceding paragraph).

Ice.—None reported during year.

Diversions.—Data do not show that large areas are irrigated in drainage above station; some land is irrigated below station with water taken from North Llano River.

Regulation.—No indication that flow at station is regulated.

Accuracy.—Stage-discharge relation practically permanent during low and medium stages. Rating curve well defined below 100 second-feet. Determinations of discharge above 100 second-feet possibly subject to error. Gage read to hundredths once daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Results excellent for medium stages and fair for extremely low stages, and possibly subject to considerable error at high stages.

Discharge measurements of North Llano River near Junction, Tex., for the period Sept. 14, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 14	Gray and Thaxton	1.25	15.6	Apr. 25	Hank and Gray	1.38	23.9
Oct. 25	R. C. Pierce	1.54	49.1	June 15	R. J. Hank	1.17	7.8
Dec. 10	Pierce and Thaxton	1.50	38.9	Sept. 16	Victor Lieb	.91	1.5
				18	do	1.04	1.4
1916.				22	do	.98	1.3
Feb. 18	R. C. Thaxton	1.45	30.6				

Daily discharge, in second-feet, of North Llano River near Junction, Tex., for the period Sept. 14, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		117	52	31	31	49	26	103	39	14	3.4	12	4.5
2		100	58	31	36	36	26	77	33	14	3.9	12	6.5
3		100	52	31	36	36	24	42	28	14	3.9	12	6.5
4		100	52	31	36	33	24	36	24	12	3.4	11	6.5
5		83	52	31	36	33	28	36	24	12	3.9	10	5.5
6		67	47	34	33	30	24	39	22	11	4.5	8.8	4.5
7		67	47	37	30	30	24	36	20	11	5.5	10	4.5
8		67	47	34	30	28	26	33	20	10	4.5	10	4.5
9		67	39	34	30	28	26	30	20	10	14	10	4.5
10		67	36	28	30	28	26	28	19	10	12	8.8	4.5
11		67	36	28	30	28	26	28	19	10	11	7.0	4.5
12		67	33	28	28	28	24	30	17	10	11	7.0	4.5
13		67	33	34	28	28	24	30	17	10	11	6.0	3.9
14	13	67	36	34	28	28	22	30	17	8.8	11	5.0	3.9
15	172	83	36	34	28	28	22	28	17	8.8	10	4.2	3.9
16		67	36	34	28	28	22	28	17	7.6	8.8	4.2	1.2
17		52	36	31	28	28	22	28	17	7.6	8.8	4.2	2.8
18		67	36	31	28	28	22	28	17	7.6	7.6	4.2	2.8
19	282	67	36	31	28	28	22	28	20	7.6	7.6	4.2	2.8
20	252	52	33	31	28	28	24	28	22	7.6	10	6.0	2.8
21	232	52	29	31	33	28	24	28	22	6.5	12	7.0	2.8
22	212	52	31	31	30	26	26	26	22	5.5	12	7.0	2.8
23	212	52	31	31	30	24	28	24	22	5.5	12	12	2.8
24	192	52	31	31	28	26	26	24	22	4.5	12	8.2	2.8
25	172	49	34	31	28	26	26	24	22	4.5	11	7.0	2.5
26	153	52	31	29	28	28	26	24	22	4.5	10	7.0	2.3
27	153	52	31	29	28	28	24	28	20	3.9	10	7.0	2.3
28	134	44	31	29	30	28	26	24	19	3.4	11	7.0	2.3
29	134	52	31	29	30	26	26	24	17	3.4	10	7.0	1.7
30	117	52	31	31	30	....	26	24	15	3.4	10	5.5	1.7
31	....	67	....	31	67	....	26	....	14	....	11	4.5	....

NOTE.—Mean gage height Sept. 16, 14.00 feet; Sept. 17, 4.30 feet; Sept. 18, 2.90 feet; discharge not determined.

Monthly discharge of North Llano River near Junction, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	117	49	66.4	4,080
November	58	29	38.1	2,270
December	37	28	31.3	1,920
January	67	28	31.4	1,930
February	49	24	29.3	1,690
March	28	22	24.8	1,520
April	103	24	33.2	1,980
May	39	14	20.8	1,280
June	14	3.4	8.29	493
July	14	8.4	8.93	549
August	12	4.2	7.61	468
September	6.5	1.2	3.64	217
The year	117	1.2	25.4	18,400

LLANO RIVER NEAR JUNCTION, TEX.

Location.—One hundred feet north of Kerrville-Junction road, a quarter of a mile northeast of Oliver's ranch house, 3 miles below confluence of North and South Llano rivers, 3½ miles east of Junction, Kimble County, 4 miles above Johnson's Fork Creek entering river from the south.

Drainage area.—1,700 square miles.

Records available.—September 13, 1915, to September 30, 1916.

Gage.—Vertical staff, reading from 0 to 7.5 feet, attached to tree on right bank, and inclined staff, reading from 7.6 to 19.5 feet, a few feet upstream from vertical staff; read by Sadie Oliver.

Discharge measurements.—Made by wading at Mason road crossing a quarter of a mile above gage, or from cable 400 feet above station.

Channel and control.—Bed composed of solid rock, clean, and permanent. Channel straight for 700 feet above and 350 feet below the gage. Left bank of medium height, slightly wooded, and subject to overflow during high water; right bank is clean, high, and not subject to overflow. One channel at all stages except during extreme floods, when a small part of the flow may follow a slough that leaves the river a short distance above the gage, passes to the south of Oliver's ranch house, and enters the main stream below the gage. Such conditions do not occur, however, at intervals more frequent than 10 to 15 years and will not greatly affect results. Rock ledge about 75 feet below gage, forming a fall of approximately 3 feet, serves as permanent control for low and medium stages.

Extremes of discharge.—Maximum stage recorded during year, 8.8 feet during night of May 21 (discharge not determined); minimum stage, 1.50 feet at 2 p. m. July 1, and 6 p. m. September 25 (discharge, 46 second-feet).

1915–16: Maximum stage recorded, 26.3 feet at 3 a. m. September 16, 1915 (discharge not determined); minimum stage July 1 and September 25, 1916 (see preceding paragraph).

Ice.—None reported during year.

Diversions.—The First Report of the Board of Water Engineers for the State of Texas shows that 4,281 acres of land have been declared irrigated requiring 8,562 acre-feet of water annually from Llano River above the station on the assumption that the duty of water is 2 acre-feet per acre. Available data show that a large part of this land is in the vicinity of Junction, near the confluence of North and South Llano rivers. A filing of 500 second-feet for continuous use in connection with hydraulic power for the Junction Gin and Waterworks is also listed in the same report.

Regulation.—No apparent regulation of the flow at this point.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 40 and 300 second-feet. Gage read to hundredths once daily; during high water oftener. Determinations of discharge above 400 second-feet may be subject to error. Daily discharge ascertained by applying mean daily gage heights to rating table. Results excellent for medium and low stages.

Discharge measurements of Llano River near Junction, Tex., for the period Sept. 13, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 13	Gray and Thaxton	1.57	72.9	Apr. 24	Hank and Gray	1.61	85.6
Oct. 26	R. C. Pierce	1.85	179	June 15	R. J. Hank	1.62	90.8
Dec. 10	do	1.76	136	Sept. 16	Victor Lieb	1.54	57.5
				18	do	1.55	61.5
1916.				22	do	1.55	62.3
Feb. 18	R. C. Thaxton	1.68	115				

Daily discharge, in second-feet, of Llano River near Junction, Tex., for the period Sept. 13, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	272	180	148	128	144	105	101	220	128	46	75	75
2	....	260	176	148	128	140	101	140	240	120	53	75	68
3	....	260	176	148	128	132	101	140	200	120	53	75	60
4	....	240	176	144	124	128	101	152	196	116	60	75	60
5	....	240	172	152	120	128	101	152	196	116	60	75	60
6	....	232	172	152	120	128	101	152	192	116	68	75	60
7	....	232	172	152	120	124	101	152	180	112	68	75	60
8	....	220	172	152	120	124	97	152	180	112	68	68	60
9	....	220	172	152	120	120	97	120	172	112	90	68	60
10	....	212	172	144	120	120	97	112	160	101	90	68	60
11	....	208	172	136	116	120	97	112	152	97	82	68	60
12	....	204	172	136	116	116	101	109	136	82	75	68	60
13	71	200	172	136	116	112	101	109	120	82	60	60	68
14	64	200	172	160	116	112	101	109	97	82	60	60	68
15	....	196	172	160	116	109	101	105	93	82	60	60	68
16	....	196	168	160	120	109	101	101	93	86	68	60	68
17	....	180	164	152	120	105	101	97	90	86	68	60	68
18	810	204	156	148	120	112	101	97	101	75	68	60	64
19	600	200	156	136	124	112	101	97	101	75	68	68	60
20	510	188	152	136	124	112	101	93	101	68	82	68	60
21	485	180	156	136	128	112	97	93	510	68	82	68	57
22	....	180	156	132	128	109	97	93	1,390	60	75	82	64
23	560	180	152	132	124	105	97	97	710	60	75	82	64
24	460	180	152	132	124	105	97	97	260	60	68	75	64
25	240	180	148	132	124	105	97	82	240	53	68	75	46
26	348	180	148	132	120	105	97	82	220	53	68	75	60
27	348	180	148	132	120	105	101	82	216	53	60	75	68
28	302	180	148	128	120	105	101	82	160	53	60	75	68
29	289	180	148	128	120	105	101	82	160	53	60	75	60
30	280	180	148	128	152	....	101	82	152	53	82	75	60
31	....	180	....	128	148	....	101	....	140	....	120	75	....

NOTE.—Mean gage height, Sept. 15, 6.05 feet; Sept. 16, 19.10 feet; Sept. 17, 4.50 feet; Sept. 22, 5.50 feet; discharge not determined.

Monthly discharge of Llano River, near Junction, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	272	180	205	12,600
November	180	148	163	9,700
December	160	128	142	8,730
January	152	116	123	7,560
February	144	105	116	6,670
March	105	97	99.8	6,140
April	152	82	109	6,490
May	1,390	90	232	14,300
June	128	53	84.4	5,020
July	120	46	69.8	4,290
August	82	60	70.7	4,350
September	75	46	62.6	3,720
The year	1,390	46	123	89,600

GUADALUPE RIVER BASIN.

GUADALUPE RIVER AT NEW BRAUNFELS, TEX.

Location.—Just below highway bridge on San Antonio-Austin post road 700 feet below International & Great Northern Railway bridge, 1 mile below mouth of Comal River, 1 mile northeast of center of New Braunfels, Comal County.

Drainage area.—1,760 square miles.

Records available.—March 13, 1898, to December 30, 1899; January 27, 1915, to September 30, 1916.

Gage.—Vertical staff; three sections attached to trees on left bank 200 feet below highway bridge and one section on east side of left pier of highway bridge; read by J. F. Willman. Gage used from March 13, 1898, to December 30, 1899, was an inclined staff gage near the present highway bridge; relation between datum of inclined gage and that of present gage not known.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Bed composed of solid rock with pockets of coarse gravel. Banks gravel, clay, and rock, slightly wooded, high, and not subject to overflow. Rock and gravel shoal just below gage serves as control; subject to slight changes.

Extremes of discharge.—Maximum stage recorded during year, 20.8 feet at 7 p. m. May 22 (discharge, determined from extension of rating curve, 28,500 second-feet); minimum stage, 1.68 feet September 23 and 24 (discharge, 370 second-feet).

1898–99 and 1915–16: Maximum stage recorded, 27.2 feet at 9.30 p. m. September 17, 1915, determined by leveling from flood marks (discharge not determined); minimum stage recorded, 1.70 feet September 27 to October 20, 1899 (discharge not determined, but according to discharge measurement of March 16, 1899, the flow was less than 358 second-feet).

Ice.—None reported during year.

Diversions.—Some water diverted for irrigation above station in Kerr and Comal counties, and, for water power, waterworks, and other municipal uses, in Kerr, Kendall, and Comal counties; amount not known.

Regulation.—Flow at this point slightly regulated by operation of power plants.

Accuracy.—Stage-discharge relation subject to slight changes. Rating curve well defined below 7,000 second-feet. Gage read to tenths once daily October 1 to November 9 and to hundredths twice daily thereafter. Mean daily gage height obtained from two readings may not be a true index of mean daily flow because of fluctuation caused by operations of power plants. Daily discharge ascertained by applying mean daily gage heights to rating table, except for periods during which stage-discharge relation was affected by shifting control. Results good.

Discharge measurements of Guadalupe River at New Braunfels, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 10	Gray and Pierce	1.95	520	Apr. 24	William Kessler	2.24	630
Dec. 20	R. C. Thaxton	1.92	506	June 13	Gray and Thaxton	2.19	635
Feb. 24	Gray and Grover	1.88	466	July 8	Gray and Hank	2.19	597
Apr. 16	Hank and Gray	7.18	5,460	Aug. 28	Hank and Lieb	1.77	407

Daily discharge, in second-feet, of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	756	535	491	480	502	450	3,810	530	876	486	618	480
2	700	535	480	475	491	440	15,200	606	864	480	596	455
3	700	535	480	480	496	430	1,800	960	840	513	562	455
4	700	535	491	551	502	435	1,170	744	816	508	540	460
5	645	535	480	557	502	430	960	672	788	496	530	455
6	645	535	557	535	491	435	840	618	750	465	502	455
7	645	535	557	508	470	435	766	584	722	568	491	450
8	645	535	491	502	480	440	711	574	711	612	502	440
9	590	535	782	502	480	435	656	557	672	546	480	430
10	590	513	656	496	475	430	623	557	634	513	480	430
11	590	508	612	496	480	430	612	530	645	491	480	425
12	590	491	557	491	480	430	596	502	650	491	470	410
13	590	530	535	480	480	430	579	496	645	491	460	405
14	590	513	502	480	475	435	562	475	623	491	455	385
15	590	546	508	480	480	430	782	465	645	480	470	380
16	590	502	502	470	475	435	5,880	475	623	486	460	380
17	590	513	508	470	475	430	1,860	475	601	465	455	380
18	590	502	502	470	475	420	1,160	562	590	465	460	380
19	590	496	513	475	475	430	936	645	596	460	480	380
20	590	491	513	470	460	425	816	960	557	450	475	380
21	535	491	502	470	455	425	760	5,960	540	465	470	380
22	535	513	496	535	470	425	689	21,400	530	810	460	375
23	535	502	491	530	475	410	658	9,730	518	546	455	370
24	535	502	480	535	455	420	628	2,510	496	518	455	370
25	535	502	480	568	460	420	606	1,840	496	546	470	380
26	535	496	480	557	450	410	618	1,520	496	524	480	390
27	535	491	480	557	430	405	596	1,340	480	518	470	380
28	535	491	502	858	450	410	562	1,200	460	524	425	380
29	535	502	475	601	455	400	546	1,100	465	618	425	430
30	535	508	480	601	....	405	524	960	470	1,250	430	420
31	535	....	475	546	....	400	....	918	....	782	480	....

NOTE.—Discharge computed by indirect method for shifting control Apr. 17 to May 19 and June 20 to July 29. Discharge Apr. 23, interpolated; Apr. 2 and May 22 estimated from extension of rating curve.

Monthly discharge of Guadalupe River at New Braunfels, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	756	535	594	36,500
November	546	491	514	30,600
December	782	475	518	31,900
January	858	470	523	32,200
February	502	430	474	27,300
March	450	400	425	26,100
April	15,200	524	1,550	92,200
May	21,400	465	1,950	120,000
June	876	460	627	37,300
July	1,250	450	550	33,800
August	618	425	483	29,700
September	480	370	410	24,400
The year	21,400	370	719	522,000

GUADALUPE RIVER NEAR GONZALES, TEX.

Location.—Just below Guadalupe highway bridge, 1½ miles south of Gonzales, Gonzales County, 1 mile below power house of Gonzales Water Power Co., 2½ miles below mouth of San Marcos River.

Drainage area.—3,620 square miles (revised).

Records available.—July 1, 1915, to September 30, 1916. The United States Weather Bureau has obtained records from a gage at power house of Gonzales Water Power Co. since September 1, 1904.

Gage.—Vertical staff in three sections on right bank just below bridge; read by Albert Garcia. Relation between this gage and that of United States Weather Bureau not known.

Discharge measurements.—Made from downstream side of highway bridge or from cable one-fourth mile below gage.

Channel and control.—Bed composed of gravel and sand; clean but somewhat shifting; channel below station is straight for 500 feet, but above is broken by an island and is straight for not more than 50 feet. Banks made up of gravel and clay; medium height; wooded along water's edge on the right and for some distance back on the left; subject to overflow only during extremely high stages. Position of control not known.

Extremes of discharge.—1915–16: Maximum stage recorded, 23.25 feet at 7 a. m. May 25, 1916 (discharge, 22,800 second-feet; result obtained from extension of rating curve and possibly subject to error); minimum stage, 1.07 feet August 16 and 17 and September 18, 1916 (discharge, 452 second-feet).

Ice.—None reported during year.

Diversions.—Some water diverted for irrigation above this point by gravity or pumping, but amount is small in comparison with the total run-off. As rainfall is nearly sufficient for general farming, irrigation is intermittent and it is extremely difficult to estimate the amount of water used.

Regulation.—Flow at this point regulated to a large extent by operation of water-power plants in the drainage above. Construction work at the dam of the Gonzales Water Power Co. causes a slight unnatural fluctuation.

Accuracy.—Stage-discharge relation not permanent. Standard rating curve fairly well-defined below 7,000 second-feet. Gage read to hundredths twice daily. Mean daily gage height based on two readings may not be true index of mean daily discharge because of fluctuation caused by power operations. Daily discharge ascertained by applying mean daily gage heights to rating table and by indirect method for shifting control. Results are fair except above 7,000 second-feet when they may be considerably in error because of poorly defined rating curve.

Discharge measurements of Guadalupe River near Gonzales, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	Pierce and Thaxton	2.15	951	May 23	Gray and Kessler	18.46	[a] 14,600
Nov. 18	Gray and Pierce	1.76	820	24	.....do	19.41	[a] 15,000
Jan. 11	R. C. Thaxton	1.80	815	26	R. C. Thaxton	12.75	5,370
Feb. 26	Gray and Grover	1.79	724	26	.....do	11.26	4,600
Apr. 4	R. C. Thaxton	16.15	[a] 10,700	26	.....do	10.21	4,410
4	Thaxton and Gray	15.34	[a] 8,880	26	.....do	9.21	3,840
4	.....do	14.47	[a] 7,850	27	.....do	5.97	2,780
4	.....do	14.00	[a] 7,430	June 20	.....do	1.74	1,010
5	.....do	7.21	3,190	July 26	Gray and Hank	1.64	751
5	.....do	6.78	2,940	Aug. 14	R. J. Hank	1.26	463
5	.....do	6.32	2,770	Sept. 29	William Kessler	1.06	471

[a] Surface velocities obtained and reduced to mean by a coefficient; results somewhat uncertain.

Daily discharge, in second-feet, of Guadalupe River near Gonzales, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,020	902	891	842	788	729	646	861	1,720	838	1,170	524
2	1,020	864	880	1,590	729	726	664	1,100	1,610	828	1,030	520
3	1,020	845	880	895	726	722	12,800	4,180	1,510	823	946	517
4	1,020	864	880	861	693	711	9,760	1,940	1,430	811	857	520
5	994	887	895	868	729	715	2,670	1,160	1,360	785	762	520
6	974	830	902	861	718	722	1,630	1,070	1,320	762	711	510
7	954	811	1,100	861	711	729	1,450	1,040	1,270	766	646	506
8	970	868	1,070	883	708	722	1,340	1,010	1,250	842	614	502
9	990	849	970	861	718	722	1,160	974	1,220	926	592	492
10	910	830	974	830	711	718	1,120	950	1,200	902	560	495
11	958	811	1,090	815	729	715	1,030	891	1,190	868	538	495
12	930	853	1,010	762	715	711	1,020	830	1,150	826	517	492
13	958	834	926	766	722	711	1,010	785	1,120	807	484	481
14	970	834	918	769	718	715	1,030	777	1,100	781	463	474
15	930	815	891	762	704	711	1,050	766	1,070	740	456	470
16	958	834	857	766	715	711	1,070	758	1,060	726	452	459
17	934	815	857	762	729	711	2,670	750	1,040	697	452	456
18	962	819	849	758	708	704	5,170	769	1,030	686	455	452
19	994	838	849	766	711	708	2,690	788	1,020	686	481	499
20	962	842	872	766	718	704	1,970	804	1,020	711	502	484
21	974	849	864	974	715	700	1,570	950	1,010	722	520	477
22	974	842	834	2,240	729	686	1,330	5,870	982	751	520	488
23	998	849	815	1,040	711	657	1,190	15,500	934	747	506	481
24	938	857	811	853	744	643	1,110	16,600	910	762	492	474
25	938	868	811	788	722	632	1,010	20,300	868	758	477	477
26	998	861	819	769	708	632	986	4,090	872	751	474	492
27	1,020	861	811	834	722	650	970	3,060	861	762	477	495
28	958	864	819	773	729	643	958	3,110	868	792	470	502
29	958	876	826	978	729	639	946	2,660	857	857	477	513
30	1,020	857	838	1,050	......	632	883	2,100	845	974	502	528
31	962	......	849	853	......	639	......	1,900	......	1,070	528	......

NOTE.—Discharge computed by indirect method for shifting control Oct. 1 to Nov. 11; Jan. 2 to Apr. 2; May 23 and May 26 to Sept. 30.

Monthly discharge of Guadalupe River near Gonzales, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,020	910	973	59,800
November	902	811	848	50,500
December	1,100	811	892	54,800
January	2,240	758	910	56,000
February	788	693	721	41,500
March	729	632	693	42,600
April	12,800	646	2,100	125,000
May	20,300	750	3,170	195,000
June	1,720	845	1,120	66,600
July	1,070	686	799	49,100
August	1,170	452	585	36,000
September	528	452	493	29,300
The year	20,300	452	1,110	806,000

GUADALUPE RIVER NEAR CUERO, TEX.

Location.—At Schleicher Bridge, 300 feet below San Antonio & Aransas Pass Railway bridge 2 miles southwest of Cuero, Dewitt County, 4 miles below a dam used for power development.

Drainage area.—5,020 square miles (revised).

Records available.—December 26, 1902, to December 31, 1906; August 19, 1915, to August 6, 1916, when station was discontinued.

Gage.—Vertical staff; low-water section attached to piling under right end of railway bridge; high-water section bolted to left pier of highway bridge; gage read by M. D. Albright. Gage used from December 26, 1902, to July, 1903, was a vertical-staff gage at Carl Buchel's power house, 3 miles north of Cuero. In July, 1903, the station was moved downstream to the San Antonio & Aransas Pass Railway bridge, and gage heights were obtained by measuring with a tagged line the distance from a reference point on the bridge to the water surface. Gage used from 1904 to 1906 was a chain gage at the railway bridge and was referred to the datum of the reference point, but the relation between that datum and the datum of the present gage is not known.

Discharge measurements.—Made from upstream side of highway bridge.

Channel and control.—Channel straight for 300 feet above and 1,500 feet below. Bed composed of rock, gravel, and sand; shifts. Left bank wooded, high, and not subject to overflow; right bank is of medium height, wooded, and is overflowed at extremely high stages. Position of control not known.

Extremes of discharge.—Maximum stage recorded during year, 19.5 feet 7 a. m. May 27 (discharge not determined); minimum stage, 3.1 feet at 7 a. m. April 30 (discharge not determined).

1902–1906: Maximum stage recorded, 43.0 feet March 1, 1903 (discharge, 71,300 second-feet); minimum stage, 5.4 feet June 20, 1906 (discharge, 370 second-feet).

Ice.—None reported during year.

Diversions.—Flow at this point not greatly affected by diversions above, as water is diverted in small amounts only.

Regulation.—Flow regulated by operation of water-power plants upstream, chiefly by a plant about 4 miles above.

Accuracy.—Stage-discharge relation not permanent. Rating curve not developed. Gage read to hundredths twice daily. Mean daily gage height based on two readings may not be a true index of mean daily discharge because of fluctuations caused by operation of power plants. Daily discharge not determined.

Discharge measurements of Guadalupe River near Cuero, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	Thaxton and Pierce....	5.08	985	Feb. 26	Gray and Grover.......	4.86	817
Nov. 18	Gray and Pierce........	5.08	916	June 18	R. C. Thaxton.........	4.92	936
Jan. 9	R. C. Thaxton.........	4.81	847				

Daily gage height, in feet, of Guadalupe River near Cuero, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	6.1	5.0	4.98	5.00	5.60	4.60	4.05	4.95	6.36	4.85	5.35
2	5.9	4.9	4.35	5.00	5.35	4.65	3.78	4.98	6.15	4.60	5.72
3	5.8	5.0	4.35	7.70	5.38	4.45	5.66	8.25	5.75	4.68	5.53
4	5.7	5.0	4.55	6.75	5.17	4.40	13.80	8.38	5.88	4.45	5.48
5	5.6	5.0	4.50	5.90	4.65	4.42	15.40	8.10	5.70	4.46	5.37
6	5.7	4.9	4.60	5.50	4.75	4.70	9.35	5.80	5.59	4.75	5.70
7	5.5	4.9	4.85	5.30	5.22	4.60	6.80	5.42	5.50	4.82	....
8	5.3	5.0	4.75	5.22	4.95	4.75	5.75	5.18	5.32	5.35	....
9	5.3	4.9	5.40	4.72	4.95	4.70	5.32	5.05	5.25	5.55	....
10	5.2	4.9	5.06	5.10	4.95	4.65	5.80	4.89	5.22	4.69	....
11	5.3	4.9	4.95	4.92	5.66	4.60	5.59	4.85	5.28	4.85	....
12	5.3	4.9	5.00	5.02	4.55	4.22	5.38	4.90	5.30	4.75	....
13	5.1	4.9	5.30	5.10	4.55	4.75	5.15	4.92	5.02	4.80	....
14	5.1	4.9	5.02	5.25	5.15	4.70	4.90	4.72	5.12	4.70	....
15	5.1	4.9	5.12	4.75	5.25	4.72	5.02	4.90	5.14	4.75	....
16	5.2	4.9	5.02	4.05	4.80	4.90	5.15	4.81	4.90	4.32	....
17	5.2	4.9	5.20	5.15	4.68	4.78	5.19	4.60	4.98	4.52	....
18	5.2	4.95	5.00	4.68	4.50	4.10	8.00	5.24	4.98	4.62	....
19	5.1	4.9	4.95	4.62	4.58	3.90	11.50	5.18	4.99	4.40	....
20	5.1	5.0	4.95	4.88	4.45	4.42	7.60	5.08	4.88	4.40	....
21	5.3	4.8	5.00	4.78	4.84	4.70	6.42	7.10	4.82	4.45	....
22	5.1	5.0	4.95	5.30	4.60	4.28	5.70	8.62	4.85	4.32	....
23	5.1	4.8	4.95	7.50	4.82	4.75	5.58	14.10	4.75	3.60	....
24	5.1	4.8	5.00	5.42	4.80	4.82	5.55	16.45	4.78	4.58	....
25	5.3	4.9	5.10	5.22	4.70	3.95	5.55	17.95	4.78	4.72	....
26	5.1	4.9	4.90	4.72	4.52	3.95	5.30	18.80	4.55	4.92	....
27	5.1	4.9	4.85	4.80	4.30	4.72	5.15	19.00	4.70	4.78	....
28	5.0	4.9	4.90	4.98	4.78	4.44	5.08	7.99	4.38	4.68	....
29	5.0	4.88	5.05	4.70	4.78	4.94	4.98	6.95	4.48	4.78	....
30	4.8	4.75	5.00	5.10	....	4.05	4.90	6.94	4.70	4.48	....
31	5.3	....	4.90	5.60	....	4.00	....	6.08	....	5.05	....

GUADALUPE RIVER BELOW CUERO, TEX.

Location.—Three-fourths mile upstream from Heard's bridge on the Arneckeville road, 1 mile south of the Dietze farmhouse, 2 miles below the Clinton bridge, 2½ miles southeast of Cuero, Dewitt County, 4 miles below the Schleicher bridge, 8 miles below dam used for power development.

Drainage area.—5,020 square miles.

Records available.—August 6, 1916, to September 30, 1916.

Gage.—Stevens water-stage recorder on left bank.

Discharge measurements.—Made from cable 40 feet upstream from gage.

Channel and control.—Channel straight above and below station for 1,000 feet. Bed composed of gravel and small rock; clean and not subject to shift. Left bank sand and dirt, covered with brush and open timber, 20 feet high, but at stages above a gage height of 20 feet is overflowed, the water submerging an area extending one-fourth mile back from the river; right bank composed of sand and dirt covered with brush and trees on sloping side and cultivated land on top; high and not subject to overflow. Rock and gravel rapids 250 feet below gage serves as a permanent control during low and medium stages.

Extremes of discharge.—Maximum stage recorded during year, from water-stage recorder, 2.92 feet at 5 a. m. August 19 (discharge, 1,510 second-feet; determined from extension of rating curve); minimum stage, from water-stage recorder, 0.88 foot at 9 a. m. September 30 (approximate discharge, 360 second-feet); determinations of both maximum and minimum discharge obtained from extension of rating curve and possibly slightly in error.

Ice.—None reported during year.

Diversions.—Diversions of small quantities of water for irrigation in upper part of Guadalupe River basin does not greatly influence flow at station. The First Report of the Board of Water Engineers for the State of Texas shows filings for 730 acre-feet per annum for the city of Cuero, 3,410 second-feet for continuous use for municipal and manufacturing plants, 2,145 acre-feet per annum for New Braunfels, Seguin, and Gonzales, and 2,900 acre-feet storage per annum in the drainage basin above station.

Regulation.—Flow regulated by operation of water-power plants upsteam, chiefly by a plant about 8 miles above.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 500 and 1,100 second-feet. Operation of the water-stage recorder satisfactory. Daily discharge ascertained by applying to the rating table mean daily gage heights determined by use of planimeter. Results excellent.

Discharge measurements of Guadalupe River below Cuero, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 6	Kessler and Lieb	1.99	855	Sept. 29	William Kessler	1.39	541
Sept. 7	Victor Lieb	1.66	667				

Daily discharge, in second-feet, of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		730	11	662	547	21	1,140	601
2		868	12	635	575	22	1,040	579
3		782	13	621	616	23	730	571
4		704	14	606	611	24	677	519
5		646	15	592	683	25	800	503
6	831	611	16	579	611	26	770	555
7	770	579	17	587	583	27	630	563
8	709	583	18	621	559	28	625	543
9	699	527	19	1,200	539	29	597	527
10	683	511	20	933	531	30	592	475
						31	662	

Monthly discharge of Guadalupe River below Cuero, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 6-31	1,200	579	730	37,600
September	868	475	594	35,300
The period				72,900

SAN MARCOS RIVER AT SAN MARCOS, TEX.

Location.—Just below Cape Ginning Co.'s mill, 300 feet southwest of the main San Marcos-Luling highway, 250 feet above the Mitchell farm house, 1 mile southeast of San Marcos, Hayes County, 1¼ miles above mouth of Blanco River, 1½ miles below dam of San Marcos Utilities Co. and the large springs that furnish a constant supply for the stream.

Drainage area.—Indeterminate.

Records available.—June 10, 1915, to January 19, 1916, March 13 to September 30, 1916. Miscellaneous measurements made from 1894 to 1908.

GAGE.—Stevens water-gage recorder on left bank, 300 feet below Cape Ginning Co.'s mill, installed March 13, 1916. Gage used June 10, 1915, to January 19, 1916, was a vertical staff gage attached to the sewer trestle of San Marcos Utilities Co., 1,000 feet below Austin-San Antonio highway bridge, 1¼ miles above present site. No known relation between datum of staff gage and that of water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from highway or railroad bridges in San Marcos.

CHANNEL AND CONTROL.—Bed composed of gravel and sand; some vegetation in the flowing water. Channel straight for 200 feet above and below the station. Water very clear, deep, and with scarcely any sediment except during floods caused by local rains. Left bank wooded, high, and not subject to overflow; right bank wooded, low, and subject to overflow, the water spreading back 100 feet to a second bank. Position of control not known; current-meter measurements indicate that it changes slightly.

EXTREMES OF DISCHARGE.—1915–16: Maximum stage, from water-stage recorder 4.05 feet at 2 a. m. April 16 (discharge, 365 second-feet), minimum stage recorded, 0.58 foot at 6 p. m. August 1 (discharge, 55 second-feet), determinations of both maximum and minimum discharge obtained from extension of rating curve and possibly subject to considerable error.

ICE.—None reported during year.

DIVERSIONS.—A concrete dam just above the San Marcos-Luling road bridge makes a pond for Roger's resort and serves as a diversion dam for an irrigation plant on left bank; diversion intermittent, but when used takes about 95 second-feet from river. A water wheel is used to pump the water for irrigation and the water that passes through it is returned to the river above Cape Ginning Co.'s dam. About 1,000 feet above the station is a dam constructed for the purpose of creating a pond from which water is pumped to the south bank lands. Only pumping plant or diversion between station and mouth of Blanco River is about 250 feet below gage. The First Report of the Board of Water Engineers for the State of Texas shows a filing for this plant for a capacity of diversion works of 3 second-feet and irrigable area of 100 acres. This report also shows filings in Hayes County, which are believed to be above the gage, of 789 acres declared irrigated by beneficial use of 1,578 acre-feet per annum. Beckman dam, just below mouth of Blanco River, is used to impound water for irrigation. During ordinary stages in San Marcos and Blanco rivers this dam backs water up San Marcos River, a distance of three-quarters of a mile, but flood stages in Blanco River create backwater at the station.

REGULATION.—Flow at station entirely regulated by dams above, the greatest effect being that produced by the power dam of the San Marcos Utilities Co., in the upper part of San Marcos, near the springs. This dam backs water over the springs that form the source of supply of the river during ordinary stages. Water is stored at this point throughout the afternoon and evening and released during the morning. Large fluctuations are also caused by operation of water wheel at Cape Ginning Co.'s mill during ginning season.

ACCURACY.—Stage-discharge relation changes slightly; rating curve is fairly well defined from 100 to 240 second-feet. The periods of backwater from Blanco River are of short duration, and the constant flow of San Marcos River allows estimates of the discharge to be made without material reduction in accuracy. Mean daily gage height determined by averaging 24-hourly readings from recorder charts. Discharge determined by the indirect method for shifting control. Results good from March 13 to September 30, but poor prior to that period. The fluctuating stage and grass growth in the channel introdued large errors in results obtained previous to March 13.

Discharge measurements of San Marcos River at San Marcos, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	Thaxton and Pierce	2.39	165	May 11	R. J. Hank	1.82	118
Nov. 20	Gray and Pierce	2.14	174	20	William Kessler	1.95	134
Dec. 20	R. C. Thaxton	2.10	147	20	do	2.34	170
Jan. 15	R. J. Hank	1.99	192	24	do	2.00	134
Feb. 27	Gray and Grover	2.07	136	June 13	Gray and Thaxton	1.95	138
Mar. 13	R. J. Hank	2.00	140	July 8	Gray and Hank	1.89	133
30	Gray and Kessler	1.92	126	28	R. J. Hank	1.96	126
Apr. 5	Thaxton and Gray	1.54	107	Aug. 15	Gray and Hank	1.85	112

NOTE.—Gage heights Oct. 13 to Feb. 27 refer to datum of staff gage 1¼ miles above the water stage recorder.

Daily discharge, in second-feet, of San Marcos River at San Marcos, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	182	149	194	182		136	134	132	134	120	131
2	178	145	230	152		139	144	125	127	126	122
3	182	118	218	218		150	128	135	126	123	123
4	182	160	206	194		142	130	141	127	121	127
5	187	160	206	237		126	109	137	124	125	122
6	171	160	196	167		133	124	137	127	126	121
7	171	160	178	230		133	128	136	131	126	116
8	171	178	178	218		142	131	130	132	118	115
9	167	187	189	206		134	134	135	135	120	116
10	160	189	167	206		138	130	130	136	123	116
11	167	213	173	206		129	127	142	128	109	114
12	171	204	180	218		138	118	136	130	100	118
13	175	206	192	225	130	132	125	134	118	105	118
14	171	206	192	228	133	126	120	132	116	106	116
15	171	201	178	264	135	172	130	136	118	109	126
16	160	194	164	242	130	218	129	135	123	106	119
17	149	184	147	225	139	130	125	133	122	109	120
18	171	182	136	256	120	130	127	134	121	108	122
19	160	175	142	189	139	140	127	128	121	112	123
20	171	164	147		121	136	134	126	120	118	124
21	171	160	138		118	136	138	125	125	123	119
22	138	169	189		120	147	144	123	126	106	117
23	128	175	171		137	134	143	123	134	109	130
24	128	182	178		140	133	138	126	126	109	121
25	128	138	149		133	138	134	125	131	115	123
26	114	164	156		126	137	133	124	131	121	129
27	138	201	160		138	137	130	124	132	127	119
28	160	182	171		135	141	135	125	132	134	122
29	182	160	145		133	120	132	121	132	138	118
30	206	158	173		133	126	133	129	124	116	119
31	171		171		134		127		135	136	

Monthly discharge of San Marcos River at San Marcos, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	206	114	164	10,100
November	206	118	174	10,400
December	230	136	175	10,800
January 1–19	264	167	215	8,100
March 13–31	140	118	131	4,940
April	218	120	139	8,270
May	144	109	130	7,990
June	142	121	131	7,800
July	136	116	127	7,810
August	138	100	118	7,260
September	131	114	121	7,200

SAN MARCOS RIVER AT OTTINE, TEX.

Location.—Above highway bridge one-fourth mile southwest of Ottine, Gonzales County, 4 miles below mouth of Plum Creek, 10 miles above confluence of San Marcos and Guadalupe rivers.

Drainage area.—Indeterminate.

Records available.—June 22, 1915, to September 30, 1916.

Gage.—Vertical staff in four sections attached to trees on left bank about 200 feet above bridge; read by J. H. Kaine. Gage used from June 22 to October 12, 1915 was a vertical staff under the highway bridge, but gage heights have been reduced to datum of present gage by means of a curve of relation.

Discharge measurements.—Made by wading at shoal 100 feet below gage or from downstream side of highway bridge.

Channel and control.—Bed composed of sand, rock, and gravel; not subject to extreme shift. Both banks high and wooded; not overflowed except by extremely high water. Channel straight above and below the station for 150 feet. During high stages in Guadalupe River backwater destroys stage-discharge relation; backwater exists only a few days each year.

Extremes of discharge.—1915-16: Maximum stage recorded, 22.2 feet at 7.30 p. m. May 22, 1916 (discharge, 5,800 second-feet). Minimum stage, 1.32 feet at 6.30 a. m. July 5, 1916 (discharge, 55 second-feet).

Ice.—None reported during year.

Diversions.—Small amounts of water are diverted by gravity or pumping for irrigation in drainage basin above station, but only a small part of the total run-off is so used.

Regulation.—Flow regulated to a slight extent by the operation of a small cotton gin a short distance above station. The operation of several small water-power plants in the upper drainage basin near San Marcos and Martindale does not materially affect the flow at this station.

Accuracy.—Stage-discharge relation permanent except during a few days when backwater from Guadalupe River occurs. Gage read once daily to hundredths. Owing to regulation of the flow the assumption that one daily gage reading gives the mean for the day causes errors in the determination. . Daily discharge ascertained by applying daily gage heights to rating table except May 22 and 23 and June 30. Results fair.

Discharge measurements of San Marcos River at Ottine, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	R. C. Pierce	2.06	194	May 23	Gray and Kessler	9.85	1,440
Nov. 19	Gray and Pierce	2.08	190	23	.....do	8.73	1,330
Jan. 12	R. C. Thaxton	2.02	184	23	.....do	7.73	1,210
Feb. 27	Gray and Grover	1.94	155	23	.....do	7.22	1,060
Apr. 4	G. A. Gray	3.98	564	24	.....do	4.75	738
5	Gray and Thaxton	3.10	400	24	.....do	4.66	695
May 3	R. J. Hank	5.52	883	June 20	R. C. Thaxton	1.91	169
3	.....do	4.92	722	July 26	Gray and Hank	2.03	182
22	Gray and Kessler	21.97	5,730	Aug. 7	Kessler and Lieb	2.00	179
23	.....do	13.31	2,070	Sept. 9	Victor Lieb	1.52	80.2
23	.....do	12.50	1,830	30	William Kessler	1.66	125
23	.....do	10.70	1,560				

Daily discharge, in second-feet, of San Marcos River at Ottine, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	232	192	168	187	221	170	133	175	240	118	365	137
2	232	173	171	377	204	164	2,430	149	217	126	274	179
3	200	173	168	202	198	160	2,600	732	213	122	198	137
4	200	183	183	321	200	160	573	291	213	122	179	175
5	183	192	202	190	183	160	413	282	221	55	160	137
6	200	192	202	175	190	164	333	225	198	59	160	126
7	200	173	331	175	188	158	274	217	194	149	179	122
8	192	183	339	171	181	160	244	187	202	149	137	130
9	183	192	183	171	179	160	225	183	183	145	160	145
10	183	217	183	171	181	158	228	187	181	175	171	141
11	183	173	183	168	175	158	198	175	202	171	122	137
12	196	183	175	179	175	160	194	168	171	206	122	122
13	200	192	175	170	171	156	175	164	168	156	118	141
14	192	183	175	164	164	158	171	164	194	152	137	141
15	200	192	175	168	160	160	168	160	190	156	156	130
16	200	173	183	170	170	156	175	160	187	122	156	111
17	192	192	183	171	175	160	1,310	156	183	130	152	104
18	200	183	175	160	166	158	553	171	168	126	156	93
19	217	194	175	164	156	164	353	160	168	164	86	100
20	200	194	183	175	156	162	365	175	160	126	493	133
21	200	171	183	563	162	149	253	1,010	152	122	111	137
22	183	168	183	664	160	145	221	4,350	156	126	118	93
23	192	171	175	187	164	141	225	1,900	139	206	213	96
24	225	190	194	185	164	143	221	759	126	255	198	104
25	164	194	194	173	162	152	194	573	133	187	198	86
26	173	194	175	179	158	149	190	473	130	217	149	93
27	173	187	183	187	164	130	187	373	137	164	130	104
28	173	168	175	190	166	156	175	365	156	175	149	90
29	173	171	175	393	160	158	175	349	145	313	137	93
30	183	168	164	244	....	158	171	295	132	156	137	93
31	200	....	171	240	....	160	....	278	....	145	175	....

NOTE.—Discharge May 22 and 23 determined from current-meter measurements made on those days, as stage-discharge relation was disturbed by backwater from Guadalupe River. Discharge June 30 interpolated; reported gage height evidently erroneous.

Monthly discharge of San Marcos River at Ottine, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	232	164	194	11,900
November	217	168	184	10,900
December	339	164	190	11,700
January	664	160	227	14,000
February	221	156	174	10,000
March	170	130	156	9,590
April	2,600	133	438	26,100
May	4,350	149	484	29,800
June	240	126	175	10,400
July	313	55	155	9,530
August	493	86	174	10,700
September	175	86	121	7,200
The year	4,350	55	223	162,000

SAN ANTONIO RIVER BASIN.

SAN ANTONIO RIVER AT SAN ANTONIO, TEX.

LOCATION.—At Presa Street Bridge, just below office of San Antonio Water Supply Co., in San Antonio, Bexar County, 3 miles below San Antonio Springs, the source of the river.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—October 23, 1914, to September 30, 1916. Miscellaneous discharge measurements were made from 1895 to 1906.

Gage.—Vertical staff attached to upstream side of second bent of bridge from right bank; read by E. L. Wilson. Gage used from October 23, 1914, to February 28, 1916, was a vertical staff gage attached to downstream side of middle bridge pier, Commerce Street Bridge; relation of the datums of these gages not known.

Discharge measurements.—Made from downstream side of Market Street Bridge, first bridge above station.

Channel and control.—Channel straight for a short distance above and below station, but the general course is very crooked. Bed composed of gravel, sand, and silt; shifts slightly. Banks high and clean; not subject to overflow except during extremely high stages, at which time the river spreads over a wide area. A rock and gravel shoal just below the station, free from vegetation and not subject to extreme shifting, serves as a control.

Extremes of discharge.—Maximum stage recorded during year, 9.40 feet at 10.45 a. m., September 25 (discharge, 2,650 second-feet), determined from extension of rating curve and possibly subject to considerable error; minimum stage, 1.30 feet March 15 to 23 (discharge, 72 second-feet).

1914–1916: Maximum stage recorded, 14.0 feet at 5.30 p. m., October 23, 1914 (discharge, 4,700 second-feet), determined from extension of rating curve and possibly subject to considerable error; minimum stage, 1.30 feet, March 15 to 23, 1916 (discharge, 72 second-feet).

Ice.—None reported during year.

Diversions.—Considerable land is irrigated in San Antonio and vicinity south of the city; quantity of water diverted not definitely known.

Accuracy.—Stage-discharge relation was affected during various periods from October 1, 1915, to February 28, 1916, by backwater from a small loose rock dam; on February 29 the gage was moved to its present location, where the relation is subject only to slight changes. Rating curve well defined for first location and well defined below 350 second-feet for present location. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage heights to rating tables except during periods when stage-discharge relation was affected by backwater. Results are good from March 1 to September 30, 1916, and fair prior to that period. The normal flow of San Antonio River comes from springs within the city limits, but two tributaries from the north furnish considerable run-off at times of heavy precipitation. Changes in stage during low flow are believed to be due to pumping from deep wells for the city water supply and the use of artesian water for irrigation in areas adjacent to the river, as it is thought that the wells draw from the underground reservoir that feeds the river by springs.

Discharge measurements of San Antonio River at San Antonio, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	Gray and Pierce	2.25	101	May 30	William Kessler	1.60	115
Dec. 21	R. C. Thaxton	2.25	92	June 23	.....do	1.37	78
Feb. 25	Gray and Grover	2.38	82	July 7	Gray and Hank	1.38	75
28	R. C. Thaxton	1.43	85	20	William Kessler	1.35	76
Mar. 10	.....do	1.30	72	Aug. 28	R. J. Hank	1.60	112
Apr. 14	William Kessler	1.42	89	Sept. 25	William Kessler	2.38	253
14	.....do	1.42	93	26	.....do	1.49	98
22	R. C. Thaxton	1.46	98				

Note.—Gage heights Nov. 11 to Feb. 25 refer to datum of gage at Commerce Street Bridge; after Feb. 25, to new gage at Presa Street Bridge.

Daily discharge, in second-feet, of San Antonio River at San Antonio, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	117	108	102	92	90	81	520	92	106	75	85	85
2	117	108	102	92	90	80	161	92	106	75	85	85
3	120	106	102	94	90	77	102	92	106	75	85	85
4	117	105	102	96	92	77	98	92	104	75	85	85
5	117	106	102	94	92	77	96	92	99	80	85	85
6	117	102	111	92	92	78	95	92	99	75	104	85
7	117	102	95	95	90	78	95	92	98	75	85	85
8	120	100	92	95	90	80	95	91	96	75	85	85
9	117	101	92	96	82	80	95	89	91	75	85	85
10	114	101	92	92	82	80	95	88	86	77	85	85
11	114	101	92	92	82	80	95	85	84	77	85	85
12	120	102	92	92	82	78	95	85	84	77	85	88
13	120	102	92	90	82	80	95	85	81	77	85	85
14	120	102	92	91	82	77	95	85	81	80	84	85
15	122	100	92	92	82	72	99	85	81	80	82	84
16	114	102	92	92	82	72	95	84	80	80	82	82
17	122	102	92	92	82	72	93	81	80	80	82	78
18	124	102	92	92	82	72	93	88	80	81	88	78
19	120	102	95	92	84	72	93	85	80	81	85	78
20	117	102	92	96	84	72	92	85	80	80	85	78
21	117	101	92	95	84	72	92	206	80	130	85	78
22	114	102	92	92	84	72	92	142	80	85	85	78
23	117	101	92	92	84	72	92	111	80	85	85	78
24	114	102	92	92	84	73	98	106	80	82	85	78
25	106	100	92	92	82	73	92	106	80	82	85	850
26	108	101	92	92	82	73	92	106	77	82	85	111
27	108	102	92	92	83	73	92	106	77	82	85	88
28	108	102	92	92	85	73	92	106	77	82	86	85
29	106	102	92	92	82	73	92	106	77	82	371	85
30	108	102	92	92	....	73	92	106	77	99	117	85
31	108	....	92	91	....	73	....	106	....	88	92	....

NOTE.—Discharge determined from rating tables Oct. 1-23, Mar. 8-31, Apr. 20 to June, 8 and July 18 to Sept. 30; by indirect method for shifting control during rest of year.

Monthly discharge of San Antonio River at San Antonio, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	124	106	116	7,130
November	108	100	102	6,070
December	111	92	94.4	5,800
January	96	90	92.7	5,700
February	92	82	85.0	4,890
March	81	72	75.3	4,630
April	520	92	111	6,600
May	206	81	98.9	6,080
June	106	77	86.2	5,130
July	130	75	81.6	5,020
August	371	82	95.9	5,900
September	850	78	110	6,550
The year	850	72	95.7	69,500

SAN PEDRO CREEK AT SAN ANTONIO, TEX.

Location.—At Commerce Street Bridge, 1½ blocks west of courthouse in San Antonio, Bexar County, 1½ miles above mouth of Salsamora and Martinez creeks, 1½ miles below San Pedro Springs, source of creek, 3 miles above confluence with San Antonio River.

Drainage area.—Indeterminate.

Records available.—July 20, 1916, to September 30, 1916.

Gage.—Vertical staff attached to wall of building No. 713 Commerce Street, on upstream side of bridge on left bank; read by E. L. Wilson.

Discharge measurements.—Made by wading near second bridge below gage.

Channel and control.—Bed composed of rock, gravel, and mud; shifting. Channel straight above and below station. Both banks formed by walls of buildings. City improvements have confined the stream to a small channel during low and medium stages, but during floods the streets are covered with water for several blocks. A shoal subject to shift, about 100 feet below gage, serves as control.

Extremes of stage.—Maximum stage recorded during year, 6.25 at 7.40 a. m. September 25; minimum stage recorded, 1.60 feet from August 10–17 and 20–27.

Ice.—None reported during year.

Diversions.—None.

Regulation.—No dams, reservoirs, or controlling works that permanently regulate the flow. Slight fluctuations were caused during year by improvement work along the channel above the gage.

Accuracy.—Stage-discharge relation not permanent. Rating curve not developed. Gage read to hundredths twice daily. Daily discharge not determined.

Entire flow of San Pedro Creek, except during times of heavy precipitation, is furnished by San Pedro Springs, and the flow at this station is believed to be that which reaches San Antonio River. Martinez and Salsamora Creeks carry no water except during heavy local rains and have been known to be dry for several years at a time.

Discharge measurements of San Pedro Creek at San Antonio, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
July 20	William Kessler	1.76	12.1	Sept. 25	William Kessler	1.98	9.2
Aug. 27	Hank and Lieb	1.73	6.3				

Daily gage height, in feet, of San Pedro Creek at San Antonio, Tex., for the year ending Sept. 30, 1916.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	......	1.62	1.75	11	......	1.60	1.68	21	2.23	1.60	1.70
2	......	1.62	1.75	12	......	1.60	1.72	22	1.62	1.60	1.70
3	......	1.62	1.70	13	......	1.60	1.70	23	1.64	1.60	1.70
4	......	1.62	1.70	14	......	1.60	1.70	24	1.65	1.60	1.70
5	......	1.73	1.70	15	......	1.60	1.70	25	1.71	1.60	2.49
6	......	1.95	1.70	16	......	1.60	1.70	26	1.64	1.60	1.95
7	......	1.68	1.69	17	......	1.60	1.70	27	1.68	1.60	1.95
8	......	1.62	1.68	18	......	1.68	1.70	28	1.64	1.65	1.95
9	......	1.62	1.68	19	......	1.62	1.70	29	1.62	2.66	1.95
10	......	1.60	1.68	20	1.65	1.60	1.70	30	2.34	1.97	1.95
								31	1.76	1.75	......

NUECES RIVER BASIN.

NUECES RIVER NEAR CINONIA, TEX.

Location.—At suspension highway bridge near Oswald's ranch, 2 miles east of Cinonia, Zavalla County, 8 miles northeast of Crystal City, 20 miles above Winter Garden ranch dam.

Drainage area.—2,060 square miles.

Records available.—July 5, 1915, to September 30, 1916.

Gage.—Vertical staff in several sections, on both banks, just below the highway bridge; read by C. C. Oswald.

Discharge measurements.—Made by wading 100 feet below bridge or from downstream side of bridge.

Channel and control.—Bed composed of clay and gravel; free from vegetation; shifts. Banks high and wooded and not subject to overflow. Channel straight above and below station. Position of control not known. The stage-discharge relation has been seriously affected at times by collection of logs, leaves, and brush below gage.

Extremes of discharge.—Maximum stage recorded during year, 18.2 feet at 7 p. m. August 19 (discharge not determined); minimum stage, 1.85 feet from July 1 to July 5 (discharge, 3.8 second-feet).

1915–16: Maximum stage recorded, 20.0 feet, at 6.30 a. m. September 19, 1915 (discharge not determined); minimum stage, July 1–5, 1916 (see preceding paragraph).

Ice.—None reported during year.

Diversions.—Considerable water diverted above station for irrigation; amount not known.

Regulation.—Available data indicate no regulation above station.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined below 200 second-feet. Gage read to half-tenths twice daily; gage heights subject to error because of careless observations. Daily discharge ascertained by applying mean gage heights to rating table except during periods for which stage-discharge relation was affected by shifting control. Discharge for high stages determined from extension of rating curve, and may be considerably in error. Results fair.

Backwater from a dam 40 feet high, constructed about 20 miles below station, extends within 2 miles of station when reservoir is full. A large part of the flow of the river is known to seep into the bed just below Uvalde, and returns to the surface just above the station. The condition of the underground waters may have an effect on this return water, and thus help to equalize the flow.

Discharge measurements of Nueces River near Cinonia, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	Thaxton and Pierce....	4.36	93.9	May 29	William Kessler........	3.87	71.6
Nov. 12	Gray and Pierce........	2.96	21.6	29	.....do.................	3.82	65.9
Jan. 4	R. C. Thaxton........	3.00	17.8	June 21	.....do.................	2.06	7.1
Mar. 13	.....do.................	2.45	17.1	Aug. 26	R. J. Hank.............	2.55	19.3

Daily discharge, in second-feet, of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	98	23	18	18	16	19	16	16	40	3.8	120	58
2	94	24	18	18	16	19	21	16	36	3.8	22	33
3	89	24	18	18	17	19	24	16	33	3.8	15	26
4	81	24	18	17	17	19	20	16	26	3.8	13	25
5	80	23	18	15	17	19	18	16	24	3.8	12	20
6	72	21	18	15	17	19	16	14	20	4.5	10	20
7	68	21	18	14	18	19	16	14	19	10	26	20
8	62	21	18	14	18	19	16	14	18	31	17	18
9	59	21	18	14	18	19	14	13	18	17	8.6	17
10	55	21	18	12	18	19	14	12	17	13	4.5	17
11	52	21	18	12	19	19	13	10	16	13	4.5	16
12	44	21	18	12	19	19	13	10	14	10	4.5	15
13	41	21	18	12	19	18	13	10	14	145	4.5	26
14	40	18	18	13	19	16	13	9.3	13	122	4.5	92
15	37	18	18	13	19	16	358	9.3	13	85	4.5	35
16	35	18	18	13	19	16	370	14	12	62	4.5	26
17	35	18	18	13	19	16	115	26	10	48	30	24
18	32	18	16	14	19	16	95	18	10	36	22	22
19	31	20	16	14	19	16	66	12	9.3	10	276	18
20	30	23	16	14	19	16	26	9.3	8.1	8.1	462	16
21	26	24	16	14	19	16	14	9.3	7.5	20	374	16
22	26	24	16	16	19	14	13	9.3	6.1	16	60	16
23	25	24	16	14	19	14	18	736	6.1	10	48	14
24	24	24	16	13	19	14	18	430	6.1	9.3	44	14
25	24	24	16	13	19	14	18	202	5.3	9.3	30	14
26	22	24	16	14	19	14	16	166	5.3	92	21	13
27	22	25	16	14	19	14	16	115	5.3	71	17	13
28	22	25	16	14	19	14	16	90	4.5	92	322	13
29	20	22	16	14	19	14	16	71	4.5	58	304	12
30	20	19	18	16	......	14	16	55	4.5	33	78	12
31	24	......	18	16	......	14	......	46	......	118	70	......

NOTE.—Discharge ascertained by use of rating table Feb. 13 to Sept. 30, and by indirect method for shifting control Oct. 1 to Feb. 12.

Monthly discharge of Nueces River near Cinonia, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	98	20	44.8	2,750
November	25	18	21.8	1,300
December	18	16	17.2	1,060
January	18	12	14.3	879
February	19	16	18.4	1,060
March	19	14	16.6	1,020
April	370	13	47.3	2,810
May	734	9.3	71.1	4,370
June	40	4.5	14.2	845
July	145	3.8	37.5	2,310
August	462	4.5	78.5	4,830
September	92	12	22.7	1,350
The year	734	3.8	33.9	24,600

NUECES RIVER NEAR COTULLA, TEX.

Location.—At Hargus dam, 4 miles west of Cotulla, Lasalle County.

Drainage area.—5,030 square miles.

Records available.—July 1, 1915, to September 30, 1916.

Gage.—Vertical staff attached to trees on right bank just above end of dam; read by Irvin Peoples.

Discharge measurements.—Made by wading below dam. No facilities for measurements at medium and high stages.

Channel and control.—Bed composed of gravel, rock, and sand; channel straight above and below station. Banks wooded, medium in height, and not subject to overflow. Long concrete dam just below gage serves as a control; crest of dam irregular.

Extremes of discharge.—1915–16: Maximum stage recorded, 6.50 feet August 22, 1916 (discharge, 23,000 second-feet; results obtained from extension of rating curve and possibly subject to considerable error); no flow during a large part of each year.

Ice.—None reported during year.

Diversions.—Large part of ordinary flow above station pumped or diverted for irrigation. The station is in upper end of an irrigated section near Cotulla. Two large filings are listed in the First Report of the Board of Water Engineers for the State of Texas, in the name of Winter Garden Irrigation Co. and Nueces Valley Irrigation Co., in Zavalla and Dimmit counties; irrigable area under each system, 10,000 acres; capacities of diversion works of 95.0 and 6.65 second-feet, respectively.

Regulation.—Flow at station regulated by storage reservoirs and pumping plants above.

Accuracy.—Stage-discharge relation practically permanent. Rating curve based on low-water discharge measurements and discharge computed by formula using the dam as a weir; possibly subject to considerable error. Because of the length of the dam (600 feet) the station is non-sensitive. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Results poor.

Discharge measurements of Nueces River near Cotulla, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	Gray and Pierce	0.15	4.1	Apr. 20	R. C. Thaxton	1.10	1,570
Jan. 5	R. C. Thaxton	−1.00	.0	21	.....do	1.10	1,410
Apr. 19	.....do	.59	671	21	.....do	1.04	1,200
19	.....do	.69	722	June 20	William Kessler	−.60	[a].3
20	.....do	1.05	1,420				

[a] Estimated leakage under dam.

Note.—Measurements on Apr. 19–21 made from bridge 6 miles below dam; due to pondage between the two points, the discharge does not represent the amount passing over the dam at the time the measurement was made. Stage-discharge relation uncertain, as the time interval could not be determined accurately.

Daily discharge, in second-feet, of Nueces River near Cotulla, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.
1	107	14			4			487	2,020
2	107	13			4			660	2,350
3	127	12			2			854	1,710
4	147	11			1			660	1,180
5	107	10			1			337	752
6	107	10			1			207	407
7	67	9			1			147	267
8	67	8						147	147
9	67	8				1,070		107	67
10	67	7				957		107	107
11	67	6				957		67	67
12	67	5				957		67	67
13	67	4				1,070		44	67
14	67	4				1		44	567
15	44	4						22	2,350
16	44	4						14	1,430
17	44	4						7	752
18	337	2		1				7	567
19	147	2		660				267	407
20	147	2		1,210				1,860	267
21	337		4	875			207	17,600	147
22	854		3	295			147	23,000	67
23	407		3	107			107	18,100	67
24	207		3	62			67	12,200	67
25	67		2	44			44	20,200	44
26	67		2	31			22	18,900	44
27	44		2	22			22	10,100	22
28	44		2	19			14	4,620	22
29	37		2	13			22	957	14
30	29		1	7			267	752	14
31	21						267	1,710	

NOTE.—No water flowing on days for which discharge is not given. Discharge interpolated Oct. 3, 29–31, Nov. 2–12, and May 6.

Monthly discharge of Nueces River near Cotulla, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	854	21	133	8,180
November	14	.0	4.63	276
December	.0	.0	.00	0
January	4	.0	.77	47
February	.0	.0	.00	0
March	.0	.0	.00	0
April	1,210	.0	112	6,660
May	4	.0	.45	28
June	1,070	.0	167	9,940
July	267	.0	38.3	2,360
August	23,000	7	4,330	266,000
September	2,350	14	535	31,800
The year	23,000	.0	448	325,000

NUECES RIVER NEAR THREE RIVERS, TEX.

Location.—At San Antonio, Uvalde & Gulf Railroad bridge 1 mile west of Kittie, 2 miles southeast of Three Rivers, Live Oak County, half a mile below mouth of Frio River.

Drainage area.—15,600 square miles.

Records available.—July 1, 1915, to September 30, 1916.

Gage.—Vertical staff, attached to center pier of railroad bridge and left bridge abutment.

Discharge measurements.—Made by wading or from highway bridge half a mile below gage.

Channel and control.—Bed composed of adobe shale; clean; does not change greatly. Channel straight above and below station. Banks wooded, high, and not subject to overflow. Position of high-water control not known; shoal just below gage probably forms low-water control.

Extremes of discharge.—1915–16: Maximum stage recorded, 30 feet August 25, 1916 (discharge, 15,500 second-feet); no flow from March 16 to April 5, 1916.

Ice.—None reported during year.

Diversions.—Considerable land irrigated above station but there appears to be no irrigable land immediately above.

Regulation.—Flow regulated somewhat by storage reservoirs and pumping in the drainage basin above, but the effect is not so pronounced as at the stations in the upper part of the drainage basin. Such water-power plants as exist in the area above the station are propably small.

Accuracy.—Stage-discharge relation changes slightly. Rating curve well defined below 7,000 second-feet. Gage read to half-tenths twice daily; oftener when fluctuations of stage are rapid or extreme. Daily discharge ascertained by applying gage heights to rating table except during periods for which discharge relation is affected by shifting control.

Discharge measurements of Nueces River near Three Rivers, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	R. C. Pierce	2.06	165	Apr. 22	William Kessler	15.84	3,910
Nov. 16	Gray and Pierce	.57	6.6	22	.....do	14.80	3,510
Jan. 6	R. C. Thaxton	.27	[a] 1.2	22	.....do	13.75	3,030
Mar. 11	.....do	.13	[a] .2	23	.....do	6.19	880
Apr. 12	William Kessler	1.58	55.1	23	.....do	5.75	769
12	.....do	1.56	53.1	June 17	.....do	1.11	7.4
13	.....do	1.40	39.9	Aug. 23	R. J. Hank	20.42	5,960
13	.....do	1.38	35.8	23	Hank and Lieb	20.72	5,980
20	.....do	10.72	2,240	24	Victor Lieb	24.46	9,380
21	.....do	15.15	3,850	Sept. 26	William Kessler	6.58	1,010
21	.....do	15.50	3,960	26	.....do	6.97	1,160
21	.....do	16.28	4,180	27	.....do	4.54	534
21	.....do	16.49	4,400	27	.....do	4.11	478
22	.....do	16.83	4,290				

[a] Estimated.

Daily discharge, in second-feet, of Nueces River near Three Rivers, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	799	181	2.4	2.0	2.9	0.1	0.0	168	245	698	2,420	5,150
2	645	173	2.4	1.7	2.4	.1	.0	132	142	586	1,990	4,550
3	624	42	2.2	1.7	2.0	.1	.0	536	620	486	1,450	3,890
4	444	28	2.2	1.7	2.0	.1	.0	742	178	396	1,140	3,100
5	302	22	1.7	1.7	2.0	.1	.0	258	91	281	1,510	2,480
6	195	18	1.3	1.7	1.7	.1	1,180	210	37	1,450	1,480	1,950
7	187	18	38	1.7	1.7	.1	3,310	107	34	592	1,540	1,490
8	187	18	16	7.2	1.7	.1	3,810	81	29	980	1,240	2,330
9	187	12	10	10	1.7	.1	596	51	23	436	1,120	3,080
10	187	12	6.4	12	1.7	.1	213	48	18	432	1,040	3,320
11	179	9.5	4.8	7.7	1.7	.1	94	43	31	306	865	3,610
12	171	9.5	3.4	5.4	1.7	.1	52	37	68	178	636	3,470
13	171	8.8	9.0	4.0	2.6	.1	34	32	28	165	427	3,080
14	171	8.1	8.1	3.2	3.2	.1	25	28	12	1,120	382	2,620
15	171	7.4	6.4	3.2	1.8	.1	22	26	17	2,060	329	2,200
16	171	6.8	5.4	3.2	1.2	.0	320	24	14	2,000	312	1,790
17	187	6.2	4.0	2.9	.6	.0	229	24	7.7	920	281	1,440
18	187	5.6	3.4	2.4	.6	.0	94	22	4.2	691	261	1,280
19	4,830	5.2	2.9	2.4	.6	.0	221	22	2.4	536	1,430	1,130
20	4,670	5.2	2.4	2.4	.5	.0	1,510	22	2.0	329	2,920	1,070
21	4,430	4.8	2.4	3.0	.4	.0	3,970	62	1.7	270	3,300	817
22	1,510	4.8	2.0	3.0	.4	.0	3,750	31	2.0	286	4,090	1,300
23	932	4.2	2.0	8.6	.4	.0	1,400	22	2.3	520	5,920	1,750
24	724	4.2	1.7	9.0	.2	.0	556	68	2.3	612	9,790	1,820
25	860	3.6	1.2	6.4	.2	.0	427	229	2.0	860	14,000	1,880
26	691	3.2	1.2	5.4	.1	.0	396	526	1.0	889	9,420	1,230
27	596	3.2	2.2	4.8	.1	.0	373	1,760	460	355	9,620	853
28	636	2.9	2.4	4.2	.1	.0	536	1,840	526	1,080	11,900	270
29	566	2.9	2.0	4.2	.1	.0	292	691	368	831	10,300	142
30	496	2.4	2.0	3.6	....	.0	232	486	532	636	7,700	128
31	197	....	2.0	3.2	....	.0	....	197	....	2,060	6,220	....

NOTE.—Discharge computed by indirect method for shifting control Oct. 1–18 and May 29 to June 26.

Monthly discharge of Nueces River near Three Rivers, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4,830	171	848	52,100
November	181	2.4	21.1	1,260
December	38	1.2	4.95	304
January	12	1.7	4.31	265
February	3.2	.1	1.25	72
March	.1	.0	.05	3
April	3,970	.0	788	46,900
May	1,840	22	275	16,900
June	620	1.0	117	6,960
July	2,060	165	746	45,900
August	14,000	261	3,710	228,000
September	5,150	128	2,110	126,000
The year	14,000	.0	722	525,000

NUECES RIVER AT CALALLEN, TEX.

Location.—At the old pump house for the city of Corpus Christi, half a mile northwest of Calallen, Nueces County, 18 miles west of Corpus Christi, 8 miles above Nueces Bay, half a mile above the edge of tidewater and the breakwater dam.

Drainage area.—16,700 square miles.

Records available.—August 12, 1915, to September 30, 1916.

Gage.—Vertical staff attached to pipe-line support of old pump house; read by Henry Wagner.

Discharge measurements.—Made by wading at the breakwater or from cable 125 feet below gage.

Channel and control.—Bed composed of clay and gravel. Channel straight above and below station. Left bank wooded, low, and bordered by levee constructed to prevent overflow; right bank wooded, medium in height, and not subject to overflow. The breakwater, which is a loose rock fill half a mile below, serves as control.

Extremes of discharge.—1915–16: Maximum stage recorded, 8.38 feet September 5, 1916 (discharge, 6,190 second-feet); minimum stage, 0.65 foot March 14 to April 6, 1916 (discharge, 9.0 second-feet).

Ice.—None reported during year.

Diversions.—Considerable water taken from river for irrigation immediately above station. The city of Corpus Christi pumps water just below the gage for municipal supply and has made a filing with the Board of Water Engineers for the State of Texas for a continuous use of 0.93 second-foot and a storage of 675 acre-feet per annum. The pumping plant is between the breakwater and cable and gage, and during low stages corrections are made for the amount pumped during current-meter measurements. A second small pump for private use installed between city intake and breakwater is seldom operated. The quantities pumped are small and do not greatly affect the natural flow during ordinary stages.

Regulation.—No water-power plants of consequence above station.

Accuracy.—Stage-discharge relation not permanent because of leakage through the breakwater dam. Rating curve is fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage heights to rating table except during periods for which stage-discharge relation is affected by shifting control. Allowance made for rising and falling stages in computing discharge. Results fair.

Discharge measurements of Nueces River at Calallen, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	Pierce and Thaxton	1.37	220	Apr. 11	William Kessler	3.82	1,880
Nov. 17	Gray and Pierce	.87	32.8	11	.....do	3.44	1,530
Jan. 7	R. C. Thaxton	.84	[a]12	11	.....do	3.11	1,260
Mar. 11	.....do	.65	[b]8.3	11	.....do	2.90	1,120
Apr. 9	William Kessler	3.83	2,130	11	.....do	2.82	1,050
9	.....do	3.88	2,150	12	.....do	2.06	498
9	.....do	3.93	2,210	June 19	.....do	.70	38.6
9	.....do	3.95	2,210	Aug. 24	R. J. Hank	4.14	2,190
10	.....do	4.26	2,400	24	.....do	4.15	2,190
10	.....do	4.30	2,430	Sept. 28	William Kessler	2.83	1,220
10	.....do	4.37	2,510				

[a] Result poor; water flowing through breakwater dam on which discharge was measured.
[b] Estimated; discharge was from springs, no flow in river a few miles upstream.

Daily discharge, in second-feet, of Nueces River at Calallen, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,330	514	32	12	20	22	9	77	385	309	1,130	5,960
2	1,390	333	32	14	20	21	9	77	230	414	1,970	6,050
3	1,000	186	32	16	20	20	9	74	183	782	2,110	5,980
4	940	117	32	16	20	20	9	72	201	934	1,530	6,100
5	804	88	32	19	20	17	9	320	201	490	1,240	6,190
6	466	68	34	19	22	17	9	684	197	594	1,320	6,110
7	306	64	38	17	22	17	15	75	197	934	1,320	5,780
8	230	64	38	17	22	16	482	73	169	847	1,320	5,520
9	194	61	38	17	22	16	2,160	73	155	922	1,320	4,930
10	176	61	38	14	22	15	2,520	70	148	783	1,100	4,390
11	155	38	38	16	24	11	1,460	70	144	678	900	3,130
12	155	34	54	15	23	10	262	56	130	490	755	2,460
13	148	29	54	15	23	10	75	41	96	706	810	2,320
14	138	29	54	14	23	9	70	32	80	804	636	1,940
15	127	29	54	14	22	9	69	31	64	1,090	508	1,900
16	130	31	41	16	22	9	69	27	54	1,610	370	1,620
17	130	31	41	16	22	9	66	24	58	1,890	172	1,280
18	130	31	41	16	22	9	69	22	54	1,640	151	1,060
19	257	31	41	16	22	9	83	22	41	860	105	776
20	632	31	41	16	22	9	77	20	39	615	313	550
21	1,850	31	29	18	22	9	669	17	39	520	1,280	550
22	2,430	31	23	17	22	9	1,490	15	39	598	1,600	958
23	1,960	31	23	17	22	9	2,310	13	39	338	2,090	990
24	1,060	32	23	15	22	9	2,330	12	38	632	2,450	1,150
25	568	32	22	15	22	9	1,630	11	38	759	2,930	1,310
26	1,090	32	21	17	22	9	440	11	36	700	3,470	1,390
27	997	32	19	17	22	9	186	11	36	700	4,140	1,160
28	825	32	16	17	22	9	72	11	36	594	4,770	1,240
29	685	32	15	17	22	9	77	1,090	36	508	5,090	860
30	615	32	13	17	......	9	83	1,470	362	490	5,690	490
31	580	......	12	17	......	9	......	478	......	894	5,870	......

NOTE.—Discharge computed by indirect method for shifting control Oct. 4–20, Nov. 1 to Feb. 9, and June 10–29.

Monthly discharge of Nueces River at Calallen, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Run-off (total in acre-feet).
October	2,430	127	693	42,600
November	514	29	72.9	4,340
December	54	12	32.9	2,020
January	19	12	16.1	990
February	24	20	21.8	1,250
March	22	9	12.1	744
April	2,520	9	561	33,400
May	1,470	11	164	10,100
June	385	36	118	7,020
July	1,890	309	778	47,800
August	5,870	105	1,890	116,000
September	6,190	490	2,800	167,000
The year	6,190	9	598	433,000

FRIO RIVER NEAR DERBY, TEX.

Location.—At International & Great Northern Railway bridge 900 feet below mouth of Leona River, 4 miles south of Derby, Frio County.

Drainage area.—3,500 square miles.

Records available.—August 1, 1915, to September 30, 1916.

Gage.—Vertical staff attached to railway bridge pier; read by John Speed.

Discharge measurements.—Made from railway bridge or by wading.

Channel and control.—Bed composed of rock, sand, and gravel; channel curved above and below station but straight at gage for 150 feet. Banks wooded, high, and not subject to overflow. A concrete dam 50 feet below gage serves as control during low and medium stages; position of high-water control not known. Point of zero flow, gage height 0.12 feet.

Extremes of discharge.—1915–16: Maximum stage recorded, 13.0 feet at 10.30 a. m. April 3, 1916 (discharge not determined); no flow in stream during several long periods.

Ice.—None reported during year.

Diversions.—Small areas are irrigated by diversion and pumping at the headwaters, but available information does not show that water is taken from this stream immediately above the station.

Regulation.—None so far as is known.

Accuracy.—Stage-discharge relation practically permanent. Gage read to hundredths once daily; oftener during extreme fluctuations. Rating curve well defined below 2,200 second-feet. Daily discharge ascertained by applying gage-heights to rating table. Results fair.

Discharge measurements of Frio River near Derby, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	R. C. Pierce	0.20	2.7	Apr. 18	R. C. Thaxton	3.39	900
Nov. 13	Gray and Pierce		.0	18	...do	2.99	779
Mar. 12	R. C. Thaxton		.0	19	...do	1.74	295
Apr. 18	...do	5.65	1,730	June 20	William Kessler		.0
18	...do	4.40	1,110	Aug. 25	Hank and Lieb	.68	48.5

Daily discharge, in second-feet, of Frio River near Derby, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.2	833	4.7	6.7		81	270
2	5.2	3,620	4.7	4.2		25	121
3	2.7	4,850	3.2	2.5		7.2	49
4	2.7	1,220	1.9	.7		2.5	25
5		215	.7			1.5	16
6		78					14
7		37					8.1
8		20					4.7
9		15					1.5
10		11					.2
11		6.2			18		
12		3.7			22		
13		1.1			5.7		
14		.4			6.7		
15		7.2			3.7		60
16		2,630					21
17		4,520					9.0
18		1,520					6.2
19	223	263					12
20	229	163	187			74	6.7
21	60	27	44			63	3.2
22	24	23	765			158	1.5
23	6.7	104	2,930			221	
24	2.7	17	1,490			132	
25	1.9	13	353			45	
26		13	182			21	
27		15	98			12	
28		11	60			8.1	
29		8.1	34			5.7	
30		6.7	23		48	160	
31			12		60	235	

Note.—No flow on days for which discharge is not given.

Monthly discharge of Frio River near Derby, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	229	0.0	18.2	1,120
November	.0	.0	.0	0
December	.0	.0	.0	0
January	.0	.0	.0	0
February	.0	.0	.0	0
March	.0	.0	.0	0
April	4,850	.4	675	40,200
May	2,930	.0	200	12,300
June	6.7	.0	.47	28
July	60	.0	5.29	325
August	235	.0	40.4	2,480
September	270	.0	21.0	1,250
The year	4,850	.0	79.4	57,700

FRIO RIVER AT FOWLERTON, TEX.

LOCATION.—At Frio River dam, about half a mile northeast of Fowlerton, Lasalle County, 1½ miles below diversion for Frio Lake storage reservoir, 8 miles below mouth of Jahuey Creek.

DRAINAGE AREA.—4,350 square miles.

RECORDS AVAILABLE.—July 1, 1915, to September 30, 1916.

GAGE.—Vertical staff attached to tree on right bank about 30 feet above dam; read by Joe McMains.

DISCHARGE MEASUREMENTS.—Made by wading below dam or from railroad bridge about a mile above.

CHANNEL AND CONTROL.—Channel straight for some distance above the station, but slightly curved below; banks about 5 feet high and not subject to overflow; right bank cultivated; left bank wooded. Concrete dam about 20 feet below gage serves as permanent control at all stages. Point of zero flow, gage height −0.05 feet.

EXTREMES OF DISCHARGE.—1915–16: Maximum stage recorded, 3.9 feet at 6 a. m., April 19, 1916 (discharge, 4,120 second-feet); no flow for extended periods.

ICE.—None reported during year.

DIVERSIONS.—Some water diverted for irrigation above station. A diversion for the Frio Lake reservoir is made 1½ miles above; other diversions are scattered; amount diverted and areas irrigated not known. A large part of the irrigated land in the drainage basin above the station is watered by wells.

REGULATION.—Flow regulated by the diversion into Frio Lake a short distance above gage; extent of regulation above Frio Lake diversion not known but probably small.

ACCURACY.—Stage-discharge relation practically permanent. Gage read once daily to hundredths; slight error may be introduced by the assumption that one reading gives the mean stage for the day. Rating curve well defined below 4,500 second-feet. Daily discharge ascertained by applying the gage heights to rating table. Results fair.

Discharge measurements of Frio River at Fowlerton, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	R. C. Pierce	0.04	0.9	May 27	William Kessler	0.76	118
Nov. 14	Gray and Pierce		.0	27	.....do	.74	156
Apr. 18	William Kessler	3.43	3,500	27	.....do	.72	157
19	.....do	3.60	3,590	27	.....do	.65	143
19	.....do	3.45	3,180	28	.....do	.49	80.9
May 26	.....do	1.63	776	June 22	.....do	−.74	[a].1
26	.....do	1.56	657				

[a] Estimated.

Daily discharge, in second-feet, of Frio River at Fowlerton, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	....	10	14	....	20	71
2	14	....	10	11	....	103	140
3	1.2	337	10	10	....	58	115
4	1.0	2,460	11	10	....	24	58
5	....	3,500	10	10	....	14	42
6	....	840	9.5	9.0	....	10	28
7	....	100	8.9	9.0	....	9.3	19
8	....	48	8.4	58	....	8.5	13
9	....	24	7.8	21	....	7.8	10
10	....	15	7.3	10	....	7.0	10
11	....	12	6.7	9.2	....	6.3	10
12	....	10	6.2	8.4	....	5.6	10
13	....	10	5.6	7.6	....	4.8	24
14	....	10	5.1	6.8	....	4.1	137
15	....	11	4.5	6.0	252	3.3	84
16	....	28	4.0	5.2	79	2.6	35
17	....	388	3.4	4.4	22	1.8	27
18	....	2,460	2.9	3.6	11	1.0	20
19	.5	3,570	2.4	2.8	10	656	12
20	....	840	1.6	2.0	9.2	774	10
21	162	133	1.0	1.0	8.4	420	9.3
22	51	63	23	.1	7.6	151	8.5
23	15	32	93	.1	6.8	129	7.8
24	5.8	22	600	....	6.0	144	7.0
25	1.8	18	1,440	....	5.2	176	6.3
26	.5	13	640	....	4.4	109	5.6
27	....	12	176	....	3.6	38	4.8
28	....	10	84	....	2.8	25	4.1
29	....	10	58	....	2.0	15	3.3
30	....	10	27	....	58	12	2.6
31	....	....	19	....	35	32	....

NOTE.—No flow in stream on days for which discharge is not given. During the high water in the early part of April a small channel was cut around the left end of the dam; no flow over dam May 5-21, June 3-7, 10-23, July 19-29, Aug. 6-18, Sept. 9-12, and 20-30; amount in by-channel estimated from data furnished by the observer and engineers.

Monthly discharge of Frio River at Fowlerton, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	162	0.0	8.77	539
November	0	.0	.00	0
December	0	.0	.00	0
January	0	.0	.00	0
February	0	.0	.00	0
March	0	.0	.00	0
April	3,570	.0	500	29,800
May	1,440	1.0	106	6,520
June	58	.0	7.31	435
July	252	.0	16.9	1,040
August	774	1.0	95.9	5,900
September	140	2.6	31.1	1,850
The year	3,570	.0	63.4	46,100

FRIO LAKE OUTLET NEAR FOWLERTON, TEX.

Location.—At Frio Lake dam, 2 miles northeast of Fowlerton, Lasalle County, 1½ miles northeast of gaging station on Frio River.

Drainage area.—Not measured.

Records available.—July 1, 1915, to September 30, 1916.

Gage.—Vertical staff attached to post on right bank about 100 feet above dam; read by Joe McMains.

Discharge measurements.—Made by wading below dam or from railroad bridge about a mile above gage.

Channel and control.—Channel straight above and below station for some distance. Right bank clean, cultivated, about 8 feet high; left bank is wooded and is from 5 to 8 feet high; neither bank subject to overflow. Concrete dam about 100 feet below gage serves as control at all stages. Point of zero flow, height gage −0.05 feet.

Extremes of discharge.—1915–16: Maximum stage recorded, 3.16 feet from 8.30 a. m. to 10 a. m. April 19 (discharge, 4,070 second-feet); no flow for extended periods.

Ice.—None reported during year.

Diversions.—Lake is used for storage; capacity not known.

Regulation.—Flow controlled at intake on Frio River, some distance above; flow of Frio River above this diversion probably not regulated.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 5,000 second-feet. Gage read to hundredths once daily; one daily gage reading may not be a true index of the mean daily discharge. Daily discharge ascertained by applying the gage heights to the rating table. Results fair.

Frio Lake is a storage reservoir fed by a diversion from Frio River. The diversion is made 1½ miles above the Frio River dam and the gaging station on the river. The water released from the lake is used for irrigation. This station is maintained in conjunction with that on Frio River at Fowlerton to show the total run-off at that point.

Discharge measurements of Frio Lake outlet near Fowlerton, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	R. C. Thaxton	0.20	8.1	May 27	William Kessler	0.40	97.7
Nov. 14	Gray and Pierce		.0	27	.....do	.40	91.6
Apr. 18	William Kessler	1.86	1,820	27	.....do	.39	86.6
18	.....do	2.13	2,350	28	.....do	.30	48.8
19	.....do	3.16	4,070	28	.....do	.30	48.3
May 26	.....do	.88	[a] 385	June 22	.....do	−.60	.0
26	.....do	.84	[a] 310	Agu. 26	Victor Lieb	.39	78.8

[a] Results poor; measuring section clogged with débris.

Daily discharge, in second-feet, of Frio Lake outlet near Fowlerton, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	41		0.4	5.4		17	29
2	26		6.8	4.0		35	101
3	11	2.4	4.0	1.6		41	76
4	10	1,960	4.7			9.6	41
5	6.8	3,380	5.4			5.4	23
6	4.7	912	3.2			4.0	23
7	3.2	80	1.6			1.6	11
8	1.6	38					8.2
9		29		17			3.2
10		11		4.7			.8
11		8.9		2.0			
12		5.4					
13		4.7					3.2
14		4.0					70
15		8.2			6.8		41
16		11			51		11
17		210			11		9.6
18		2,010			6.8		6.8
19		2,950			3.2	410	5.4
20	2.0	870			1.6	730	2.4
21	70	123				370	
22	56	41	2.8			112	
23	32	35	29			61	
24	20	17	420			85	
25	10	14	1,160			112	
26	7.5	8.9	590			85	
27	5.4	9.6	123			23	
28	3.6	1.6	41			7.5	
29	2.4	.8	32			3.2	
30	.8	.8	17		11	2.4	
31			8.2		61	11	

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of Frio Lake outlet near Fowlerton, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	70	0	10.1	621
November	0	0	.0	0
December	0	0	.0	0
January	0	0	.0	0
February	0	0	.0	0
March	0	0	.0	0
April	3,380	0	425	25,300
May	1,160	0	79.0	4,860
June	17	0	1.16	69
July	61	0	4.92	303
August	730	0	68.6	4,220
September	101	0	15.5	922
The year	3,380	0	50.0	36,300

RIO GRANDE BASIN.

RIO GRANDE AT EMBUDO, N. MEX.

LOCATION.—Near sec. 27, T. 23 N., R. 9 E., 100 feet below the Santa Barbara Tie & Pole Co.'s bridge, a few hundred feet below the Denver & Rio Grande Railroad eating house at Embudo, a short distance above mouth of the box canyon, in the southeastern part of Rio Arriba County. Nearest tributary, Embudo Creek, joins the Rio Grande about 3 miles above station.

DRAINAGE AREA.—Approximately 10,100 square miles.

RECORDS AVAILABLE.—December 21, 1888, to December 31, 1903; September 8, 1912, to September 30, 1916.

GAGE.—Friez water-stage recorder on right bank. From January 1 to February 28, 1889, an inclined staff gage was maintained 1 mile above Embudo, but it was moved to a point 1,500 feet above the Santa Barbara Tie & Pole Co.'s bridge March 1, 1889, and used until December 31, 1903; relation of datum of these gages unknown, but the datum remained unchanged from March 1, 1889, to December 31, 1903. A Friez water-stage recorder, referred to a new datum, was installed September 8, 1912, on the downstream side of the Santa Barbara Tie & Pole Co.'s bridge pier and this gage was operated until June 20, 1914, when it was moved to the present site; datum unchanged since station was reestablished in 1912.

DISCHARGE MEASUREMENTS.—Made by wading or from cable just below gage.

CHANNEL AND CONTROL.—Bed composed of rock, gravel, and sand; shifts at extremely high stages. Banks high and not subject to overflow. A shoal just below station serves as a control.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 9.9 feet at 6 a. m. May 13 (discharge, 16,000 second-feet); minimum stage, 2.28 feet at 2 p. m. October 14 (discharge, 393 second-feet).

1888–1903; 1912–1915: Maximum stage recorded, 15.8 feet June 19, 1903 (discharge, 15,900 second-feet); minimum stage recorded, 6.6 feet June 13, 1899 (discharge, 65 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Considerable water diverted for irrigation above station. Between the Colorado-New Mexico State line and Embudo the river flows through a canyon and water is diverted for irrigation only in the small areas of bottom lands bordering the stream. Above the State line and along the tributaries entering the Rio Grande in the canyon large areas of land are irrigated by diversions.

REGULATION.—The operation of storage reservoirs in Colorado affect the discharge to slight extent.

ACCURACY.—Stage-discharge relation practically permanent, except for one temporary change; not affected by ice during year. Rating curve well defined between 400 and 7,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined from inspection of gage-height graph except during period for which stage-discharge relation is affected by shifting control. Results excellent.

Discharge measurements of Rio Grande at Embudo, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	W. R. King	3.54	1,100	Sept. 14	Follansbee and Wallace	3.32	887
May 23	do	5.79	3,230				

Daily discharge, in second-feet, of Rio Grande at Embudo, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	660	483	407	479	495	740	1,340	4,260	2,770	1,320	745	800
2	614	479	535	467	539	695	1,380	4,080	2,750	1,240	882	740
3	614	471	531	459	527	650	1,340	3,490	2,710	1,170	1,960	725
4	600	479	539	471	523	685	1,430	3,020	2,660	1,140	1,750	730
5	596	467	582	483	515	710	1,370	2,820	2,690	1,100	2,250	715
6	578	475	614	483	511	680	1,300	3,000	2,960	1,030	2,470	705
7	551	479	586	475	523	675	1,240	4,080	3,060	1,000	2,300	685
8	523	463	596	467	555	705	1,180	5,760	2,840	940	2,360	655
9	487	432	582	487	568	730	1,060	8,520	2,710	882	2,470	645
10	475	424	573	503	568	750	1,070	12,000	2,690	855	2,650	645
11	447	443	560	507	578	789	1,130	13,900	2,900	800	2,360	645
12	424	428	535	503	622	822	1,140	15,200	3,520	800	2,250	645
13	407	435	515	467	640	904	1,130	15,400	3,930	800	2,140	745
14	396	444	491	459	622	994	1,180	13,800	4,120	970	1,840	882
15	410	452	531	479	636	1,010	1,230	12,300	3,970	1,140	1,750	882
16	424	461	527	495	670	1,050	1,280	10,300	3,770	1,170	1,890	855
17	435	469	443	499	670	1,140	1,400	6,700	3,600	1,280	2,040	828
18	435	478	424	515	675	1,160	1,600	4,840	3,600	1,480	1,990	772
19	435	487	447	811	695	1,200	1,640	4,780	3,[illegible]70	1,360	1,940	720
20	451	495	447	591	705	1,280	1,550	4,290	3,670	1,320	1,890	695
21	459	535	428	543	715	1,440	1,620	4,050	3,670	1,140	1,750	670
22	447	609	443	511	730	1,580	1,640	3,810	3,520	1,030	1,520	645
23	443	660	455	507	740	1,680	1,660	3,220	3,300	940	1,440	645
24	430	735	471	527	767	1,800	1,800	2,990	3,030	855	1,400	645
25	424	735	467	523	762	1,700	2,110	3,040	2,710	818	1,200	622
26	428	636	451	523	789	1,540	2,470	3,020	2,300	781	1,140	600
27	455	573	471	515	789	1,390	2,770	3,090	2,040	744	1,030	578
28	467	523	430	519	778	1,340	3,150	3,010	1,800	707	970	564
29	471	455	376	531	745	1,340	3,370	2,840	1,570	670	910	564
30	475	414	487	519	....	1,340	3,970	2,780	1,400	695	882	564
31	483	....	487	471	....	1,300	....	2,790	....	745	855	....

NOTE.—Discharge interpolated Nov. 14–19; July 25–28; gage heights not available. Rise Nov. 21–28 due to release of stored water in Colorado. Discharge computed by indirect method for shifting control Mar. 21 to May 17.

Monthly discharge of Rio Grande at Embudo, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	660	396	482	29,600
November	735	414	504	30,000
December	614	376	498	30,600
January	811	459	509	31,300
February	789	495	643	37,000
March	1,800	650	1,090	67,000
April	3,970	1,060	1,680	100,000
May	15,400	2,780	6,040	371,000
June	4,120	1,400	3,000	179,000
July	1,480	670	997	61,300
August	2,650	745	1,680	103,000
September	882	564	694	41,300
The year	15,400	376	1,490	1,080,000

RIO GRANDE NEAR SAN MARCIAL, N. MEX.

LOCATION.—In sec. 19, T. 7 S., R. 1 W., at the Atchison, Topeka & Santa Fe Railway bridge, 1 mile south of San Marcial. No important tributaries enter in the immediate vicinity of the station.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 29, 1895, to September 30, 1916.

Gage.—Inclined staff established January 29, 1895, and destroyed by flood in 1896. Wire gage established in its place at same datum. This was soon abandoned and gage heights have since been obtained by measuring with a graduated rod from the bridge deck to the water surface. Gage datum unchanged.

Discharge measurements.—Made from the bridge.

Channel and control.—Sandy and very shifting; broken by several bridge piers. No information on control section.

Extremes of discharge.—Maximum mean daily discharge during year, 15,100 second-feet on May 14; minimum mean daily discharge, 125 second-feet on October 4, 1895–1916: Maximum mean daily discharge, 33,000 second-feet on October 11, 1904; minimum mean daily discharge, no flow for several periods.

Diversions.—Considerable water diverted for irrigation above station.

Accuracy.—Stage-discharge relation not permanent; not affected by ice. Owing to the shifting control, determinations of daily discharge are based almost entirely on frequent current-meter measurements.

Cooperation.—Records furnished by United States Reclamation Service, and reduced to three significant figures by the United States Geological Survey.

Discharge measurements of Rio Grande near San Marcial, N. Mex., during the year ending Sept. 30, 1916.

[Made by King and Kabelin.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 3	9.9	262	Feb. 3	11.4	582	June 6	12.5	3,810
6	10.1	302	6	11.7	871	9	12.7	4,110
9	10.1	235	9	11.7	622	12	12.6	3,720
12	10.1	237	12	11.8	908	15	13.0	4,110
15	10.2	218	15	11.9	850	18	12.8	3,790
18	10.1	234	18	11.9	981	21	12.5	3,300
21	10.0	174	21	12.0	979	24	12.5	2,940
24	9.9	212	24	12.1	1,130	27	12.0	2,270
27	10.1	163	29	12.0	790	30	11.9	1,450
30	10.1	156	Mar. 3	12.3	1,170	July 3	11.3	944
Nov. 3	10.4	214	6	11.8	746	6	11.3	544
6	10.5	290	9	12.1	1,080	9	11.3	375
9	10.7	281	12	12.0	1,080	12	11.4	514
12	10.7	432	15	12.5	1,980	15	11.7	784
15	10.7	345	18	12.9	2,800	18	11.8	1,070
18	10.8	389	21	13.1	3,240	21	12.0	1,370
21	10.8	367	24	14.2	7,110	24	11.5	783
25	11.0	468	27	13.0	4,470	27	11.8	939
28	11.4	734	Apr. 4	12.7	3,130	31	12.1	1,260
Dec. 4	11.1	521	7	13.4	4,580	Aug. 3	11.4	1,480
7	11.4	663	10	13.0	2,730	6	11.6	1,410
10	11.5	693	13	12.8	2,660	9	12.2	2,460
13	11.5	722	16	13.0	3,610	12	11.8	1,870
16	11.4	566	19	13.2	4,120	15	11.9	1,660
19	11.6	707	22	13.0	4,210	18	12.4	2,310
22	11.1	459	25	13.1	4,040	23	12.4	2,390
25	11.3	448	28	13.9	4,950	26	11.8	1,510
28	11.5	466	May 1	14.2	8,210	29	11.7	974
31	11.7	684	4	13.5	6,630	31	11.6	925
Jan. 3	11.3	427	7	13.3	5,220	Sept. 3	11.3	600
6	11.4	495	10	14.1	8,960	6	11.4	472
9	11.6	564	14	15.2	[a] 15,400	9	11.3	294
12	11.5	539	16	14.6	13,100	12	11.6	526
15	11.8	764	19	13.4	8,400	15	11.4	248
18	11.7	777	22	13.3	6,710	18	11.4	247
21	12.2	1,670	25	12.8	5,130	21	11.6	300
24	11.8	1,010	28	12.9	5,920	24	11.4	242
27	11.6	769	31	12.8	5,020	27	11.2	179
31	11.6	772	June 3	12.7	4,700	30	11.2	173

[a] Estimated; meter lost in observations.

Daily discharge, in second-feet, of Rio Grande near San Marcial, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	365	165	650	620	630	980	4,480	8,320	4,700	1,150	1,160	760
2	325	195	575	555	630	1,040	3,580	7,640	4,860	1,030	1,700	655
3	240	214	550	430	580	1,170	3,140	7,420	4,700	902	1,420	600
4	125	250	525	460	630	960	3,140	6,530	3,820	769	1,390	520
5	300	285	525	495	680	830	3,140	4,820	4,210	678	1,500	445
6	305	290	595	530	820	750	2,910	4,400	3,810	544	1,510	470
7	155	255	665	530	740	855	4,800	5,040	4,000	488	2,210	290
8	250	265	650	565	655	910	3,460	6,400	3,920	432	2,260	320
9	225	280	680	565	620	1,080	2,940	8,120	3,980	375	2,460	295
10	230	300	695	530	590	1,120	2,730	9,140	3,480	375	2,240	295
11	235	350	690	515	710	1,040	2,730	10,000	3,300	578	1,940	290
12	240	430	730	540	910	1,140	2,500	11,600	3,880	578	1,800	525
13	205	375	700	615	855	1,620	2,580	14,300	3,540	424	1,540	230
14	190	345	625	620	750	2,260	3,820	15,100	3,820	694	1,630	215
15	220	315	560	765	800	1,980	3,800	14,400	4,160	784	1,580	195
16	225	345	530	700	845	2,290	3,610	13,300	4,100	352	1,460	250
17	230	365	600	775	990	3,320	3,100	12,800	3,560	640	2,540	360
18	235	370	600	745	980	2,700	3,480	10,300	3,720	928	2,000	250
19	175	380	670	1,200	930	2,800	4,240	8,210	3,380	849	1,960	295
20	175	375	585	1,330	1,030	3,020	4,300	5,020	3,460	1,070	1,910	345
21	205	365	535	1,670	980	3,240	4,220	6,720	3,300	1,370	1,930	255
22	240	390	440	1,570	980	4,120	4,220	6,720	3,350	1,140	295	270
23	215	415	450	1,060	1,020	5,000	4,220	5,760	3,060	841	1,680	255
24	155	440	435	1,010	1,120	7,110	3,830	5,610	2,940	783	1,500	230
25	155	465	425	950	970	5,790	4,080	4,820	2,880	783	1,580	210
26	160	500	445	830	890	5,620	4,270	5,000	2,740	756	1,430	210
27	165	565	445	770	806	4,360	4,780	5,760	2,200	913	1,230	180
28	160	735	440	890	800	4,100	4,890	5,920	1,970	512	955	190
29	160	715	575	830	790	3,840	6,580	6,090	1,600	459	900	175
30	155	695	575	710	......	3,660	8,210	5,560	1,370	406	700	175
31	155	......	685	715	......	4,200	......	5,020	......	1,420	925	......

Monthly discharge of Rio Grande near San Marcial, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	365	125	212	13,000
November	735	165	381	22,700
December	730	425	576	35,400
January	1,670	430	777	47,800
February	1,120	580	818	47,100
March	7,110	750	2,670	164,000
April	8,210	2,500	3,930	234,000
May	15,100	4,400	7,930	488,000
June	4,860	1,370	3,460	206,000
July	1,420	352	743	45,700
August	2,540	295	1,590	97,800
September	760	175	325	19,400
The year	15,100	125	1,960	1,420,000

RIO GRANDE AT EAGLE PASS, TEX.

Location.—Half a mile above the highway bridge between Eagle Pass, Tex., and Ciudad Porfirio Diaz, Mexico.

Drainage area.—Not measured.

Records available.—May 1, 1900, to April 30, 1916, when station was discontinued.

Gage.—Vertical and inclined staff.

Discharge measurements.—Made from cable.

Channel.—Extremely shifting; banks subject to large amount of overflow, beginning at stage of 22 feet.

Extremes of discharge.—Maximum stage recorded during year, 6.5 feet in afternoon of October 3 (discharge, 15,980 second-feet for mean daily gage height of 6.25 feet); minimum stage recorded, 1.6 feet February 27–29 (discharge, 2,130 second-feet).

1900–1916: Maximum stage recorded, 34.6 feet at midnight June 29, 1905 (mean daily discharge June 30, 1905, 238,300 second-feet); minimum mean daily discharge, 1,030 second-feet, April 15, 1913.

Diversions.—No information.

Accuracy.—Owing to the shifting control, estimates of daily discharge are based almost entirely on frequent current-meter measurements.

Cooperation.—Station maintained and records furnished by the Commission for the Equitable Distribution of the waters of the Rio Grande.

Discharge measurements of Rio Grande at Eagle Pass, Tex., during the year ending Sept. 30, 1916.

[Made by L. C. Gilliam and C. F. Carson.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 6	4.8	7,197	Dec. 20	2.2	2,927	Mar. 3	2.5	3,162
16	3.0	4,898	23	2.0	2,807	6	2.4	3,124
18	2.9	4,066	31	2.0	2,668	9	2.6	3,228
21	2.8	4,185	Jan. 4	2.0	2,538	12	2.5	3,173
24	2.6	3,720	8	2.0	2,479	15	2.5	3,160
28	2.6	3,678	13	2.0	2,492	18	2.5	3,163
31	2.6	3,618	15	2.0	2,543	21	2.5	3,144
Nov. 3	2.5	3,461	18	2.0	2,569	24	2.5	3,165
6	2.4	3,393	21	2.0	2,631	27	2.4	3,146
9	2.4	3,390	24	2.0	2,495	31	2.4	3,133
12	2.3	3,371	27	2.0	2,381	Apr. 3	2.35	3,113
15	2.3	3,287	31	2.0	2,458	6	2.45	3,144
18	2.2	3,159	Feb. 3	2.0	2,316	9	2.4	3,145
22	2.0	3,020	6	1.9	2,283	12	2.5	3,162
25	2.0	2,886	9	1.8	2,295	15	2.45	3,138
30	2.0	2,892	12	1.8	2,378	18	2.45	3,150
Dec. 3	2.0	2,953	15	1.7	2,146	21	2.35	3,144
6	2.0	2,900	18	1.7	2,171	24	2.0	3,100
9	2.0	2,879	21	1.6	2,147	27	1.7	3,034
13	2.0	2,860	24	1.6	2,137	30	1.5	2,958
16	2.1	2,832	26	1.6	2,139			

Note.—Measurements Jan. 13 to Feb. 26 made by C. F. Carson.

Daily discharge, in second-feet, of Rio Grande at Eagle Pass, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	9,280	3,570	2,910	2,530	2,390	3,190	3,130
2	12,230	3,510	2,930	2,530	2,460	3,160	3,120
3	15,980	a3,460	a2,950	2,540	a2,460	a3,160	a3,110
4	12,950	3,460	2,930	a2,540	2,460	3,130	3,110
5	10,530	3,390	2,920	2,520	2,370	3,120	3,120
6	a7,500	a3,390	a2,900	2,510	a2,260	a3,120	a3,140
7	6,690	3,390	2,890	2,500	2,280	3,120	3,130
8	6,300	3,390	2,890	a2,480	2,260	3,120	3,130
9	5,980	a3,390	a2,880	2,470	a2,290	a3,230	a3,140
10	5,730	3,390	2,870	2,460	2,320	3,190	3,150
11	5,660	3,390	2,870	2,450	2,350	3,170	3,160
12	5,600	a3,380	2,860	a2,440	a2,380	a3,160	a3,160
13	5,470	3,340	a2,860	2,490	2,380	3,160	3,150
14	5,340	3,410	2,850	2,520	2,220	3,160	3,150
15	5,150	3,340	2,840	a2,540	a2,150	a3,160	a3,140
16	a4,900	a3,290	a2,830	2,540	2,150	3,160	3,140
17	4,900	3,290	2,840	2,550	2,160	3,160	3,140
18	a4,670	a3,160	2,900	a2,570	a2,170	a3,160	a3,150
19	4,470	3,160	2,910	2,590	2,160	3,150	3,160
20	4,270	3,120	a2,930	2,610	2,150	3,150	3,150
21	a4,190	3,050	2,830	a2,630	a2,150	a3,140	a3,140
22	4,070	a3,020	2,820	2,590	2,140	3,150	3,150
23	3,950	2,970	a2,810	2,550	2,140	3,160	3,130
24	a3,720	2,930	2,790	a2,500	a2,140	a3,170	a3,100
25	3,710	a2,890	2,770	2,460	2,140	3,170	3,090
26	3,700	2,890	2,760	2,420	a2,140	3,160	3,050
27	3,690	2,890	2,740	a2,380	2,130	a3,150	a3,030
28	a3,680	2,890	2,720	2,400	a2,130	3,150	2,990
29	3,680	2,890	2,700	2,420	2,130	3,150	2,970
30	3,620	a2,890	2,690	2,440	....	3,140	a2,960
31	a3,620	....	a2,670	a2,460	....	a3,130	....

a See also discharge-measurement table.

Monthly discharge of Rio Grande at Eagle Pass, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	15,980	3,620	5,974	367,299
November	3,570	2,890	3,218	191,464
December	2,950	2,670	2,841	174,682
January	2,630	2,380	2,500	153,700
February	2,460	2,130	2,245	129,132
March	3,230	3,120	3,155	196,300
April	3,160	2,960	3,110	185,000
The period				1,400,000

RIO PUEBLO DE TAOS NEAR TAOS, N. MEX.

Location.—About sec. 2, T. 25 N., R. 13 E., at Glorietta Grove, 2 miles above Taos Pueblo, 4½ miles northeast of Taos, near the center of Taos County. A number of intermittent tributaries enter above and below the station.

Drainage area.—Not measured.

Records available.—December 19, 1910, to December 9, 1916, when station was discontinued. Fragmentary records March to December, 1910

Gage.—Bristol water-stage recorder installed on the right bank a short distance above Glorietta Grove. A vertical staff gage was installed April 7. 1910, but was destroyed by flood before July 12, 1910. On October 12, 1910. a new gage was installed at the same site, but was referred to a datum 0.27 foot lower than the original. The water-stage recorder was installed December 19, 1910, at the same site and referred to the datum of the second gage.

Discharge measurements.—Made by wading or from footbridge.

Channel and control.—Bed of stream composed of rock and gravel; flows through a series of pools and rapids. Banks are low, but are seldom overflowed because of the small discharge. Control shifting.

Extremes of discharge.—Not determined.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—One small diversion above station and several below.

Regulations.—None.

Accuracy.—Stage-discharge relation not permanent; control shifting during high water. Standard rating curve fairly well defined. Operation of water-stage recorder unsatisfactory. Weekly staff gage readings available. Daily discharge ascertained by indirect method for shifting control. Results fair.

Discharge measurements of Rio Pueblo de Taos near Taos, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 8	W. R. King	2.17	36.5	July 4	C. R. Dwire	1.12	51
May 21	do	3.24	194	Sept. 12	Follansbee and Mondragon	1.38	13.3

Daily discharge, in second-feet, of Rio Pueblo de Taos near Taos, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	12	6.4	9.6	8.4	7.4	11	31	201	183	60	27	......
2	11	6.4	11	7.4	8.4	11	29	174	......	......	28	15
3	12	7.4	12	9.6	8.4	9.6	31	134	166	......	24	......
4	13	6.4	8.4	9.6	8.4	12	35	134	......	50	24	......
5	14	9.6	8.4	9.6	8.4	12	33	192	......	......	23	......
6	14	8.4	7.4	12	8.4	13	31	250	......	......	24	......
7	14	7.4	7.4	13	8.4	11	33	325	......	......	24	......
8	13	11	6.4	11	8.4	14	35	358	......	42	24	......
9	11	11	8.4	8.4	9.6	16	35	402	......	......	24	15
10	11	8.4	12	7.4	9.6	23	40	402	149	......	24	......
11	12	4.8	8.4	7.4	9.6	31	56	336	......	47	24	......
12	13	6.4	6.4	7.4	8.4	35	56	270	......	......	25	13
13	12	8.4	7.4	7.4	8.4	43	46	325	......	38	......	......
14	11	7.4	9.6	9.6	9.6	46	46	......	......	......	......	......
15	9.6	9.6	8.4	9.6	9.6	43	40	......	......	30	......	......
16	9.6	12	9.6	8.4	11	40	40	......	......	......	......	12
17	9.6	11	12	8.4	14	50	53	......	119	......	......	12
18	12	7.4	8.4	8.4	14	50	87	......	......	34	......	......
19	12	12	9	8.4	13	46	93	......	......	......	18	......
20	13	9.6	9.5	12	13	50	68	220	......	32	......	......
21	12	8.4	10	12	13	53	68	192	......	......	......	......
22	12	8.4	10	12	13	53	82	......	......	32	......	......
23	9.6	9.6	11	9.6	12	50	99	......	......	......	......	11
24	9.6	11	12	8.4	13	46	112	210	77	......	......	......
25	13	6.4	12	8.4	12	38	149	......	......	32	......	......
26	13	5.6	8.4	8.4	13	31	166	......	......	......	17	......
27	9.6	8.4	8.4	8.4	13	31	157	270	......	31	......	......
28	12	7.4	7.4	8.4	13	33	166	......	......	......	......	......
29	12	7.4	9.6	8.4	13	40	230	......	......	27	......	......
30	9.6	8.4	11	9.6	......	35	260	240	......	......	......	10
31	7.4	......	12	9.6	......	33	......	......	......	......	......	......

Daily discharge, in second-feet, of Rio Pueblo de Taos near Taos, N. Mex., for the period Oct. 1 to Dec. 1, 1916.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				16			
2			11	17			
3				18		13	
4		14		19			
5				20			
6				21	16		
7	12			22			
8				23			
9				24			
10				25		10	
11		11		26			
12				27			
13				28	15		
14	21			29			
15				30			
				31			

Monthly discharge of Rio Pueblo de Taos near Taos, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	14	7.4	11.6	713
November	12	4.8	8.40	500
December	12	6.4	9.40	578
January	13	7.4	9.25	569
February	14	7.4	10.7	616
March	53	9.6	32.6	2,000
April	260	29	80.2	4,770

RIO LUCERO NEAR TAOS, N. MEX.

Location.—In sec. 11, T. 26 N., R. 13 E., just above head gate of Seco ditch, at mouth of canyon, 9 miles above Taos, near center of Taos County. No important tributaries near station.

Drainage area.—17 square miles (measured by Indian Service Survey).

Records available.—December 17, 1910, to September 30, 1916. Fragmentary records from March to October, 1910.

Gage.—Bristol water-stage recorder on the right bank at same site and datum as staff gage which was used April 7 to December 16, 1910. Gage read by Manuel Mondragon.

Discharge measurements.—Made by wading or from footbridge 500 feet upstream from gage.

Channel and control.—Bed composed of sand and gravel. Banks are of medium height, but are not overflowed, as discharge is small. Control just below gage; shifts badly.

Extremes of discharge.—Data too meager to determine.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—None above station; below station water is diverted for irrigation.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control badly shifting. Operation of water-stage recorder so unsatisfactory that records were discarded; weekly staff gage readings available; poorly defined rating curve applied indirectly during year. Discharge determined only for days on which staff gage was read. Results poor.

Discharge measurements of Rio Lucero near Taos, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 9	W. R. King	1.24	17.5	July 4	C. R. Dwire	1.58	72
May 21	do	1.74	87	Sept. 12	Follansbee and Mondragon.	1.28	18.4

Daily discharge, in second-feet, of Rio Lucero near Taos, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1				13			19			68		
2	10											17
3									130			
4			14			15			74			
5					10						28	
6		14						49				
7												
8				13			16			57		
9	9						18					22
10									149			
11			14			25						
12					14						28	18
13		22						149				
14												
15				14			20			45		
16	6											16
17									126			
18			13			29						
19					16						21	
20		18						106				
21								87				
22				14			29			38		
23	9											14
24									87			
25			13			19						
26					16						20	
27		16						134				
28												
29				14			47			31		
30	16											11
31												

NOTE.—Discharge estimated because of ice Dec. 18, 25, Jan. 1 and 8.

Daily discharge, in second-feet, of Rio Lucero near Taos, N. Mex., for the period Oct. 1 to Dec. 2, 1916.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				16			
2			9	17			
3				18		12	
4		13		19			
5				20			
6				21	17		
7	11			22			
8				23			
9				24			
10				25		9	
11		14		26			
12				27			
13				28	15		
14	23			29			
15				30			
				31			

CHAMA RIVER NEAR CHAMA, N. MEX.

Location.—In sec. 25, T. 31 N., R. 3 E., at highway bridge on main road from Chama to Tierra Amarilla, 2½ miles southeast of Chama, 200 feet above mouth of Little Chama River, in northern part of Rio Arriba County.

Drainage area.—Not measured.

Records available.—May 27, 1914, to September 30, 1916. From September 23, 1912, to May 26, 1914, a station was maintained on Chama River at Chama, 2 miles upstream. No intervening tributaries of consequence.

Gage.—Stevens water-stage recorder attached to downstream side of bridge pier.

Discharge measurements.—Made by wading or from highway bridge.

Channel and control.—Bed composed of sand, gravel, and rock. Banks are of medium height but are not overflowed except during extremely high stages. Control located at rapids 100 feet downstream; shifts slightly.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 4.65 feet at midnight May 7 (discharge, 1,550 second-feet); minimum stage, 1.53 feet at 4 p. m. November 5 (discharge, 22 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—City ditch diverts approximately 2 second-feet from June to September.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifted after high water; affected by ice during winter. Rating curve fairly well defined; applied indirectly May 9 to September 30. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage heights determined from inspection of gage-height graph. Results good.

Discharge measurements of Chama River near Chama, N. Mex., during the year ending September 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 12	King and Cowdrey.....	2.62	265	Aug. 7	G. S. Cowdrey, jr......	1.95	111
May 8	G. S. Cowdrey, jr......	3.95	1,210	Sept. 16	Follansbee and Cowdrey	1.66	47.6

Daily discharge, in second-feet, of Chama River near Chama, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	33	26	....	117	1,020	787	370	165	52
2	33	25	....	134	655	747	350	191	50
3	33	25	....	152	599	747	340	180	50
4	31	24	....	149	755	739	321	128	49
5	29	24	....	126	952	700	311	123	47
6	30	26	....	117	1,140	708	284	165	58
7	29	....	....	110	1,440	662	256	110	46
8	29	....	....	117	1,720	619	231	101	41
9	28	....	....	142	2,020	648	210	92	152
10	27	....	....	214	1,840	700	199	94	110
11	27	....	....	292	1,510	692	202	72	76
12	26	....	....	270	1,260	626	188	69	63
13	26	....	....	274	1,220	619	159	108	57
14	26	....	....	270	1,060	592	149	94	52
15	27	....	....	244	880	540	156	86	51
16	29	....	....	274	787	546	239	88	49
17	28	....	....	407	771	552	146	74	47
18	27	....	....	521	755	558	184	66	47
19	27	....	....	462	846	564	134	62	46
20	27	....	....	370	916	571	126	60	46
21	26	....	423	365	771	521	128	63	44
22	26	....	311	560	723	508	117	56	43
23	26	....	302	710	715	479	115	56	41
24	26	....	202	860	795	456	117	57	41
25	26	....	149	1,000	907	439	126	60	40
26	26	....	123	1,150	984	426	115	60	40
27	26	....	126	1,150	872	412	128	56	39
28	26	....	172	1,320	872	396	117	55	38
29	26	....	180	1,500	898	386	110	53	39
30	26	....	139	1,350	898	381	110	60	38
31	26	....	126	....	854	....	126	56	....

NOTE.—Discharge Apr. 20-May 1, June 16-19 estimated from comparative hydrographs of other stations in basin.

Monthly discharge of Chama River near Chama, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	33	26	27.7	1,700
November 1-6	26	24	25.0	298
March 21-31	423	123	205	4,470
April	1,500	110	491	29,200
May	2,020	599	1,010	62,100
June	787	381	577	34,300
July	370	110	187	11,500
August	191	53	88.9	5,470
September	152	38	53.1	3,160

CHAMA RIVER AT PARK VIEW, N. MEX.

LOCATION.—In sec. 7, T. 29 N., R. 4 E., at highway bridge half a mile northwest of Park View, about 800 feet below confluence of Brazos and Chama Rivers, in north-central part of Rio Arriba County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 25, 1912, to September 30, 1916, when station was discontinued.

GAGE.—Friez water-stage recorder attached to downstream side of right bridge pier. During 1912 and 1913 the recorder was attached to the downstream side of right abutment of bridge but was moved to the present site because of changes in channel in 1914; original datum unchanged.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

Channel and control.—Bed composed of large cobblestones, sand, and gravel; shifts extremely during high water. Right bank high and not subject to overflow; left bank is low and is overflowed at extremely high stages. Control composed of loose bowlders and coarse gravel; 100 feet downstream.

Extremes of stage.—Maximum stage during year, from water-stage recorder, 5.85 feet at 9 a. m. May 5. Minimum stage from water-stage recorder, 2.88 feet September 28.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Between Chama and Park View approximately 8 second-feet is diverted from Chama River and 16 second-feet from intervening tributaries during irrigation season.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifts extremely during and after high water; measurements insufficient to permit estimates to be made by indirect method. Operation of water-stage recorder fairly satisfactory.

Discharge measurements of Chama River at Park View, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 13	King and Cowdrey	4.25	602	July 18	G. S. Cowdrey, jr	3.54	360
May 11	G. S. Cowdrey, jr	5.55	4,210	Sept. 15	Follansbee and Cowdrey	3.04	77

Daily gage height, in feet, of Chama River at Park View, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.17	3.08		5.08	5.08	3.94	3.57	3.21
2	3.15	3.06		4.96	5.04	3.89	3.60	3.18
3	3.13	3.06		4.78	4.97	3.84	3.76	3.20
4	3.12	3.06		4.93	4.96	3.78	3.48	3.18
5	3.11	3.06		5.17	4.89	3.77	3.41	3.15
6	3.12	3.07			4.95	3.75	3.64	3.33
7	3.12	3.16			4.87	3.71	3.42	3.22
8	3.11	3.17			4.83	3.60	3.40	3.15
9	3.10	3.16	4.07		4.84	3.64	3.31	3.50
10	3.09	3.18	4.25		4.86	3.63	3.32	3.52
11	3.09	3.08	4.46	5.45	4.85	3.80	3.25	3.24
12	3.09		4.38	5.40	4.78	3.58	3.23	3.15
13	3.10		4.33	5.42	4.76		3.53	3.10
14	3.10		4.31	5.44	4.72		3.44	3.06
15	3.10		4.36	5.37	4.67		3.62	3.04
16	3.12	2.86	4.39	5.34	4.61	3.87	3.76	3.01
17	3.12		4.66	5.33	4.59	3.60	3.46	
18	3.12		4.85	5.35	4.58	3.53	3.35	
19	3.11		4.80	5.32	4.53	3.47	3.28	
20	3.10		4.54	5.35	4.46	3.46	3.28	
21	3.09		4.54	5.17	4.37	3.44	3.31	
22	3.08		4.86	5.16	4.30	3.45	3.25	
23	3.08		4.95	5.19	4.23	3.48	3.28	2.92
24	3.08		5.06	5.38	4.18	3.48	3.30	2.89
25	3.08		5.22	5.48	4.12	3.52	3.25	2.87
26	3.08		5.30	5.42	4.08	3.38	3.31	2.84
27	3.07		5.29	5.22	4.06	3.46	3.27	2.83
28	3.07		5.39	5.28	4.03	3.43	3.24	2.81
29	3.08		5.45	5.28	4.00	3.50	3.18	2.81
30	3.08		5.33	5.27	3.97	3.50	3.33	2.80
31	3.08			5.21		3.58	3.26	

Note.—Stage-discharge relation affected by ice Nov. 7-10.

CHAMA RIVER NEAR EL VADO, N. MEX.[1]

Location.—In T. 28 N., R. 2 E., at entrance to box canyon, 1 mile below El Vado, 15 miles southwest of Tierra Amarilla, near center of Rio Arriba County. Nutrias Creek, which is the south line of the Tierra Amarilla land grant, joins Chama River from the north 4 miles below station.

Drainage area.—Not measured.

Records available.—September 28, 1913, to September 30, 1916.

Gage.—Stevens water-stage recorder attached to rock wall on right bank.

Discharge measurements.—Made by wading or from cable just above gage.

Channel and control.—Bed composed of solid rock overlain with gravel; changes slightly. Banks are high and not subject to overflow. Rock reef just below gage serves as control.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 9.1 feet at 7 a. m. May 10 (discharge, 4,860 second-feet); minimum stage, −0.10 foot at noon October 28 (discharge, 28 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Between Park View and the station near El Vado, approximately 3 second-feet is diverted from Chama River and 2 second-feet from intervening tributaries during irrigation season.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifts between fairly well defined limits; affected by ice during winter. Rating curve fairly well defined; applied indirectly May 9 to August 15. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined from inspection of gage-height graph. Results good.

Discharge measurements of Chama River near El Vado, N. Mex., during the year ending Sept. 30, 1916.

Date	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 13	King and Cowdrey	3.27	903	July 18	G. S. Cowdrey, jr	1.48	329
May 12	G. S. Cowdrey, jr	7.05	3,480	Sept. 16	Follansbee and Cowdrey	.41	85

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[1] Known as "Chama River near Tierra Amarilla" in previous reports.

Daily discharge, in second-feet, of Chama River near El Vado, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	60	41	....	1,910	2,320	535	453	126
2	55	55	....	1,700	2,280	497	506	102
3	52	53	....	1,500	2,090	465	573	92
4	50	54	....	1,570	2,240	429	326	90
5	49	61	....	2,050	2,050	402	274	86
6	50	61	....	2,700	2,160	400	450	83
7	50	49	....	3,300	1,990	360	334	129
8	49	47	....	3,700	1,900	369	269	100
9	48	48	774	4,060	1,870	344	221	86
10	46	48	914	4,280	1,900	366	192	252
11	46	50	1,220	4,290	1,910	470	182	303
12	44	43	1,040	3,530	1,820	360	208	170
13	45	....	958	3,570	1,720	340	221	136
14	47	....	954	3,500	1,640	350	366	113
15	44	....	942	2,750	1,520	405	245	97
16	44	....	946	2,420	1,440	455	673	89
17	42	....	1,190	2,450	1,340	347	374	85
18	41	....	1,460	2,300	1,320	329	234	83
19	36	....	1,440	2,550	1,300	271	184	83
20	39	43	970	2,860	1,200	278	159	82
21	39	....	938	2,210	1,080	269	168	76
22	38	....	1,220	2,300	966	245	154	71
23	40	....	1,500	2,360	906	306	127	68
24	38	....	1,600	2,540	814	257	208	65
25	41	....	1,860	3,010	762	303	143	62
26	41	....	1,980	2,960	711	262	139	60
27	39	....	1,960	2,680	662	250	137	59
28	35	....	2,240	2,660	629	339	136	58
29	44	....	2,570	2,680	586	245	124	58
30	42	....	2,420	2,620	563	329	106	58
31	38	....	....	2,560	....	366	154	....

NOTE.—Discharge estimated July 11-16 from comparative hydrographs of stations in same basin.

Monthly discharge of Chama River near El Vado, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	60	35	44.3	2,720
November 1-12, 20	61	41	50.2	1,290
April 9-30	2,570	774	1,410	61,500
May	4,290	1,500	2,760	170,000
June	2,320	563	1,460	86,900
July	535	245	353	21,700
August	673	106	259	15,900
September	303	58	100	5,950

BRAZOS RIVER NEAR BRAZOS, N. MEX.

LOCATION.—At mouth of the box canyon 3 miles east of Brazos, 15 miles southeast of Chama, in northern part of Rio Arriba County, about 1½ miles above mouth of Little Brazos River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 18, 1913, to September 30, 1916.

GAGE.—Friez water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable near gage.

CHANNEL AND CONTROL.—Bed of stream composed of rock, gravel, and sand; permanent except during high stages when slight changes occur. Banks are of medium height and are overflowed only during extremely high stages. Control at small rapids 150 feet downstream; practically permanent.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 4.07 feet at 9 p. m. May 24 (discharge 2,760 second-feet); minimum stage, 0.29 foot at 4 p. m. November 11 (discharge, 10 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—None above station; approximately 8 second-feet diverted below during irrigation season.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined between 15 and 2,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table daily gage heights determined from inspection of gage height graph. Results excellent.

Discharge measurements of Brazos River, near Brazos, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	King and Cowdrey	0.90	76	July 18	G. S. Cowdrey, jr.	1.06	127
May 13	G. S. Cowdrey, jr.	3.28	1,840	Sept. 16	Follansbee and Cowdrey	.65	32.6

Daily discharge, in second-feet, of Brazos River near Brazos, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	24	16		698	1,500	295	152	50
2	24	15		668	1,420	277	192	45
3	23	17		617	1,410	258	207	52
4	21	17		729	1,360	241	105	41
5	21	16		981	1,370	232	98	36
6	21	17		1,510	1,310	228	211	61
7	21	16		1,940	1,160	215	120	38
8	21	14		1,920	1,090	207	117	26
9	21	14		1,960	1,050	188	88	65
10	20	12		1,970	1,000	192	88	180
11	19	12		1,860	934	335	76	80
12	19	16		1,840	896	192	72	57
13	19	15		2,000	854	169	102	46
14	18	15		1,800	819	199	126	40
15	19	15	80	1,440	745	180	88	36
16	22	15	85	1,350	706	254	203	34
17	21		126	1,340	691	159	108	32
18	20		159	1,420	668	142	80	30
19	19		169	1,650	646	117	67	34
20	17		152	1,490	588	111	67	35
21	18		136	1,260	528	102	78	35
22	17		135	1,370	490	120	63	34
23	17		177	1,510	452	114	56	34
24	18		232	1,880	417	95	65	32
25	17		305	2,080	388	98	59	29
26	17		383	1,840	483	78	72	28
27	17		428	1,690	345	76	63	26
28	16		541	1,690	335	74	70	25
29	17		653	1,740	315	80	54	25
30	17		729	1,700	315	162	65	24
31	17			1,610		199	67	

Note.—Discharge interpolated Nov. 7-10, 13-16, because of ice.

Monthly discharge of Brazos River near Brazos, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	24	16	19.3	1,190
November 1-16	17	12	15.1	479
April 15-30	729	80	281	8,920
May	2,080	617	1,530	94,100
June	1,500	315	809	48,100
July	335	74	174	10,700
August	211	54	99.3	6,110
September	180	24	43.6	2,590

PECOS RIVER NEAR DAYTON, N. MEX.

LOCATION.—In sec. 13, T. 18 S., R. 26 E., 3 miles east of Dayton, Eddy County, half a mile above mouth of Penasco River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24, 1905, to September 30, 1916.

GAGE.—Stevens water-stage recorder on right bank; installed August 27, 1914, at same site and datum as staff gage installed September 7, 1905. Original gage, which was 100 feet below the mouth of Penasco River and half a mile below present gage, was washed out September 6, 1905.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifts, especially during high stages. Right bank consists of clay, left bank of sand; both are subject to overflow during extremely high stages. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.73 feet from 11 a. m. to 1 p. m. August 24 (discharge, 7,200 second-feet). Minimum stage 2.45 feet from 11 p. m. July 26 to 1 a. m. July 27 (discharge, 23 second-feet).

ICE.—None reported during year.

DIVERSIONS.—Considerable water is diverted above station for the use of irrigable valley lands; quantity not known but not in conflict with rights of Carlsbad project of the United States Reclamation Service, which serves about 20,000 acres in the vicinity of Carlsbad and stores part of the water used near Carlsbad in Lake McMillan, 10 miles below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; periods of change are covered by discharge measurements. Daily gage heights determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging hourly gage heights. Discharge determined by indirect method for shifting control.

COOPERATION.—Records furnished by the United States Reclamation Service.

Discharge measurements of Pecos River near Dayton, N. Mex., during the year ending Sept. 30, 1916.

[Made by engineers of United States Reclamation Service.]

Date.	Gage height.	Dis-charge.	Date.	Gage height.	Dis-charge.	Date.	Gage height.	Dis-charge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 1	5.30	1,039	Jan. 24	4.88	590	June 10	4.19	283
Oct. 2	5.42	849	Feb. 1	4.00	312	June 21	3.77	207
Oct. 11	3.43	219	Feb. 10	3.98	321	July 1	2.76	43
Oct. 21	3.55	228	Feb. 21	2.75	266	July 1	2.76	44
Oct. 21	3.54	228	Mar. 1	3.57	204	July 11	2.77	47
Nov. 1	2.93	137	Mar. 12	3.16	144	Aug. 1	2.94	67
Nov. 11	2.88	133	Mar. 21	4.25	383	Aug. 10	5.80	605
Nov. 23	3.63	248	Apr. 1	3.71	237	Aug. 21	6.06	945
Dec. 1	3.42	206	Apr. 19	4.88	542	Aug. 26	7.51	2,050
Dec. 11	3.91	293	May 3	5.63	849	Sept. 1	4.92	451
Dec. 22	3.81	274	May 14	6.60	1,497	Sept. 12	4.57	229
Jan. 1	3.84	266	May 21	5.63	746			
Jan. 11	3.88	272	June 1	4.76	431			

Daily discharge, in second-feet, of Pecos River near Dayton, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	651	139	206	274	337	212	246	786	404	43	60	260
2	771	141	197	284	316	189	230	745	368	38	35	374
3	529	141	205	343	325	176	228	820	335	78	30	1,524
4	377	141	210	338	325	170	203	1,158	305	70	28	536
5	305	137	210	310	325	169	201	1,074	292	51	27	1,352
6	278	135	222	310	325	158	212	865	282	43	27	1,052
7	268	135	245	308	325	155	207	745	278	62	244	740
8	295	135	261	300	325	149	194	718	272	76	945	326
9	258	133	308	294	325	148	205	673	292	78	1,600	260
10	232	134	310	282	322	150	222	685	280	44	600	214
11	209	135	302	278	310	151	387	855	284	38	470	189
12	200	141	305	264	304	142	385	1,074	264	30	416	316
13	203	184	285	280	295	140	398	1,172	270	30	370	656
14	214	214	263	284	290	141	397	1,413	252	28	456	752
15	240	226	262	288	288	136	529	1,375	216	28	418	326
16	215	230	280	296	287	133	606	1,222	212	28	392	236
17	576	222	283	294	288	142	666	1,150	192	30	300	192
18	398	212	284	296	280	234	558	1,102	188	40	262	177
19	290	215	280	300	265	352	507	1,054	182	30	470	163
20	256	252	275	300	268	382	445	864	192	30	530	152
21	226	254	278	324	270	382	671	742	192	28	640	144
22	200	256	282	338	278	340	795	660	174	25	1,100	138
23	187	256	280	621	267	307	730	554	163	26	2,000	130
24	181	238	283	542	235	292	677	520	159	28	6,300	124
25	177	214	282	433	245	370	558	487	141	28	2,350	120
26	173	216	283	379	250	373	492	487	135	25	1,280	119
27	172	220	296	367	242	394	534	454	114	25	830	117
28	162	238	302	336	247	388	589	414	102	30	638	113
29	152	228	302	338	240	376	596	400	72	30	578	111
30	145	213	290	328	......	346	631	400	50	128	512	109
31	144	......	282	326	......	298	......	404	......	120	446	......

Monthly discharge of Pecos River near Dayton, N. Mex., for the year ending Sept. 30 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	771	144	280	17,200
November	256	133	191	11,400
December	310	197	269	16,500
January	621	264	331	20,400
February	337	235	290	16,700
March	394	133	242	14,900
April	795	194	443	26,400
May	1,413	400	809	49,700
June	404	50	222	13,200
July	128	25	44.8	2,750
August	6,300	27	786	48,300
September	1,524	109	367	21,800
The year	6,300	25	357	259,000

NOTE.—Monthly discharge computed by engineers of United States Geological Survey.

Days of deficiency in discharge of Pecos River near Dayton, N. Mex., for the years ending Sept. 30, 1905–1916.

Discharge in second-feet.	Days of deficient discharge.										
	1905 -6	1906 -7	1907 -8	a 1908 -9	1909 -10	1910 -11	1911 -12	1912 -13	1913 -14	1914 -15	1915 -16
50	......	......	7	80	19	......	1	3	......	......	28
75	......	......	54	119	61	9	18	26	......	4	34
100	13	12	94	154	106	37	34	83	3	22	37
125	20	40	136	171	179	91	62	151	37	34	47
150	49	75	162	200	216	120	82	184	68	37	76
175	64	84	173	225	237	165	109	218	105	42	88
200	84	120	180	230	248	193	126	234	118	56	106
250	115	148	189	263	272	248	185	262	172	85	155
300	158	175	210	285	320	282	241	295	236	116	222
350	188	208	244	318	324	303	280	320	258	157	264
400	225	243	279	339	331	311	303	333	271	226	284
450	242	262	299	342	339	317	309	340	276	263	294
500	254	282	306	346	344	325	315	344	278	275	301
550	267	307	314	347	347	329	327	346	288	283	310
600	287	318	314	347	349	336	332	347	294	292	317
650	304	328	314	347	349	337	332	349	297	299	323
700	320	339	319	347	353	339	338	349	305	306	331
800	337	347	322	350	354	341	342	350	312	317	341
900	347	351	326	352	355	347	346	352	317	327	346
1,000	351	358	334	352	355	350	357	353	326	333	347
1,200	358	359	341	354	356	357	362	356	336	243	356
1,400	358	361	343	356	357	359	365	356	344	349	300
1,700	361	363	353	356	358	360	365	358	354	354	363
2,000	362	364	358	356	358	361	365	358	357	356	363
2,500	363	364	361	356	360	362	365	362	359	361	365
3,000	364	364	363	356	360	362	365	362	362	361	365
4,000	365	365	365	356	361	362	366	362	363	362	365
6,000	......	......	365	357	362	362	......	364	363	362	365
8,000	......	......	366	......	363	363	......	364	364	362	366
10,000	......	......	......	......	365	364	......	364	364	362	......
15,000	......	......	......	......	......	365	......	365	364	363	......
50,000	......	......	......	......	......	......	......	......	365	365	......

[a] Daily discharge for July 26 to Aug. 2, 1908, not included. Figures given for discharge above 90 second-feet are therefore subject to error.

PECOS RIVER AT CARLSBAD, N. MEX.

Location.—In the SE. ¼ sec. 6, T. 22 S., R. 27 E., at Green Street Bridge in Carlsbad, Eddy County, 300 feet downstream from Atchison, Topeka & Santa Fe Railway station, 1,500 feet above mouth of Dark Canyon, 2,000 feet below Hagerman Dam.

Drainage area.—Not measured.

Records available.—May 28, 1903, to March 31, 1908, and May 13, 1914, to September 30, 1916.

Gage.—Vertical staff, attached to the upstream side of middle bridge pier installed May 18, 1914. Gage used from May 28, 1903, to October, 1904, was an inclined staff gage at the present site. From October, 1904, to March 31, 1908, vertical staff gage at the same site was used.

Discharge measurements.—Made by wading or from bridge.

Channel and control.—Bed composed of gravel and rock; nearly permanent, but changes may occur after high stages and slight changes have taken place during the lower stages. Banks of medium height; not subject to overflow. Position of control not known.

Extremes of discharge.—Maximum stage recorded during year about 21.0 feet August 7 (discharge, 85,700 second-feet [1]); minimum stage, 0.75 foot December 2–19 (discharge 95 second-feet).

1903–1908, 1914–1916: Maximum stage recorded about 21.0 feet August 7, 1916 (discharge, 85,700 [1] second-feet); minimum discharge 60 second-feet January 10–12 and 21, 1915 (gage height 0.80 foot).

Ice.—None reported during year.

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[1] Discharge at Avalon dam; reported by engineers of United States Reclamation Service.

Diversions.—Large quantities of water are stored a few miles above station in Lakes McMillan and Avalon by the United States Reclamation Service for irrigating lands near Carlsbad. Water is also diverted for irrigation in valleys adjacent to river above Lake McMillan. Capacity of storage reservoirs in connection with the Carlsbad project, 58,500 acre-feet. Considerable water seeps into the river between the storage reservoirs and the gaging station, the quantity depending on the quantity being used for irrigation between the two points.

Regulation.—Flow at this point completely controlled by storage reservoirs of the Carlsbad project.

Accuracy.—Stage-discharge relation not permanent. Standard rating curve fairly well defined below 8,000 second-feet. Gage read to half-tenths once daily. One daily reading may not be a true index of the mean daily discharge because of fluctuations due to operation of gates at storage reservoirs. Daily discharge ascertained by applying daily gage heights to rating table except during periods for which the stage-discharge relation is affected by shifting control. Results fair.

Cooperation.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of Pecos River at Carlsbad, N. Mex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 23	R. J. Hank	2.08	924	Aug. 18	William Kessler	2.00	472
July 18	do	.76	87.2	Sept. 20	R. J. Hank	1.55	181

Daily discharge, in second-feet, of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,400	217	105	395	115	185	125	137	161	125	105	137
2	1,200	275	95	395	115	155	125	179	161	125	115	278
3	525	395	95	395	115	140	125	383	161	125	110	419
4	425	395	95	395	115	140	125	443	161	125	105	2,100
5	335	185	95	395	115	140	125	581	413	125	105	3,870
6	305	155	95	395	115	140	125	2,440	149	125	105	2,000
7	335	155	95	395	115	125	125	1,200	149	125	1,100	167
8	275	155	95	395	115	125	125	323	149	125	27,000	113
9	335	140	95	395	115	125	125	217	143	125	691	154
10	335	140	95	395	115	125	125	149	137	125	611	195
11	335	140	95	185	115	125	125	149	137	125	469	236
12	365	115	95	185	115	755	125	383	789	125	300	277
13	317	115	95	185	110	125	125	443	125	125	131	318
14	335	115	95	185	105	125	125	1,280	125	125	469	359
15	335	115	95	185	105	125	125	383	125	125	407	299
16	335	115	95	185	105	125	125	1,100	125	125	347	255
17	365	115	95	185	115	125	125	1,860	125	105	161	211
18	365	115	95	185	115	125	125	1,000	125	105	235	167
19	365	115	95	185	115	125	125	235	125	105	347	167
20	353	115	275	185	115	125	125	651	125	105	317	245
21	335	105	225	155	115	125	125	176	125	105	287	167
22	347	105	225	155	140	125	125	176	125	105	1,220	167
23	353	105	205	155	140	125	440	469	125	105	16,500	137
24	329	105	205	155	155	125	789	161	125	105	10,300	137
25	305	105	225	155	155	125	1,770	161	125	105	8,500	123
26	287	105	225	155	155	125	245	161	125	105	6,500	123
27	275	105	225	155	1,960	125	137	161	125	105	4,700	123
28	265	105	225	140	395	125	137	161	125	115	2,970	123
29	250	105	205	140	185	125	137	161	125	115	1,240	113
30	250	105	205	128	....	125	137	161	125	925	974	113
31	233	....	205	115	....	125	....	161	....	105	707	....

Note.—Discharge computed by indirect method for shifting control Apr. 24 to June 12, Aug. 9-22, and Aug. 29 to Sept. 30. Discharge Aug. 7-8 furnished by U. S. Reclamation Service and based on flow at Lake Avalon.

Monthly discharge of Pecos River at Carlsbad, N. Mex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,400	233	393	24,200
November	395	105	148	8,810
December	275	95	144	8,850
January	395	115	239	14,700
February	1,960	105	195	11,200
March	755	125	150	9,220
April	1,770	125	218	13,000
May	2,440	137	505	31,100
June	789	125	165	9,820
July	925	105	142	8,730
August	27,000	105	2,810	173,000
September	3,870	113	443	26,400
The year	27,000	95	467	339,000

EVAPORATION NEAR CARLSBAD, N. MEX.

Location.—At head gates on Lake Avalon of the United States Reclamation Service, 6 miles north of Carlsbad. Approximate elevation about 3,200 feet above sea level.

Records available.—August, 1914, to August, 1916.

Equipment.—Heavy galvanized-iron pan, 3 feet square and 18 inches deep, floated on reservoir. Auxiliary equipment, standard rain gage, thermometer, and measuring cup.

Evaporation near Carlsbad, N. Mex., for the year ending Sept. 30, 1916.

Month.	Temperature.		Rainfall.	Evaporation.
	In pan.	Outside of pan.		
	° F.	*° F.*	*Inches.*	*Inches.*
October	64	62	.12	5.90
November	51	52	.00	4.46
December	46	45	.52	3.34
January	42	43	.20	3.36
February	49	49	.12	3.33
March	56	56	.05	6.20
April	58	58	1.34	6.29
May	66	67	.20	8.77
June	73	74	.06	10.82
July	76	77	4.87	9.25
August 1-7	77	79	.00	2.02
The period	....	....	7.48	63.74

Note.—Pan destroyed Aug. 7 by high water.

PECOS RIVER NEAR ANGELES, TEX.

Location.—In T. 26 S., R. 29 E., just below Pecos Valley Railroad bridge crossing Delaware Creek at its mouth, 2 miles north of the New Mexico-Texas State line, 2½ miles southeast of Red Bluff, Eddy County, N. Mex., 8½ miles northwest of Angeles, Reeves County, Tex.

Drainage area.—Not measured.

Records available.—May 27, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder installed over a vertical float box drift bolted to the first outcrop of rock on the right bank about 600 feet below railroad bridge and mouth of Delaware Creek.

Discharge measurements.—Made by wading or from cable half a mile downstream.

Channel and control.—Bed and banks composed of sand, gravel, and rock; banks not subject to overflow. Control formed by a series of rapids about 200 feet below the gage; shifts slightly.

Extremes of discharge.—Maximum stage during year, 21.5 feet 10 a. m. August 8, measured by leveling from flood marks (discharge not determined); minimum stage from water-stage recorder, 0.20 foot the last part of February or the first part of March (discharge, 140 second-feet).

1914–1916: Maximum stage recorded, 21.5 feet 10 a. m. August 8, 1916; minimum discharge, 124 second-feet at 10 p. m. July 6, 1915 (gage height from water-stage recorder, 0.23 foot).

Ice.—Stage-discharge relation not seriously affected by ice; open channel rating curve assumed applicable.

Diversions.—The Carlsbad project of the United States Reclamation Service, with reservoirs of a capacity of 58,500 acre-feet, diverts a large part of the natural run-off above Carlsbad, N. Mex. During the season of irrigation considerable water is returned to the stream by seepage from the lands in the vicinity of Carlsbad. In addition to the water used by the Carlsbad project, some diversions are made for irrigation in the basin above the storage reservoirs of the Carlsbad project.

Regulation.—The operation of a water-power plant of 300 horsepower capacity above station, just below Carlsbad, N. Mex., does not materially regulate flow at gage. The flow is, however, regulated to a large extent by waters stored in the reservoirs of the Carlsbad project. In the season of irrigation the effect of the regulation is decreased by return seepage waters, but during the winter the flow depends on water released at the reservoirs.

Accuracy.—Stage-discharge relation not permanent. Standard rating curve, used for computing daily discharge by indirect method for shifting control, fairly well defined between 140 and 4,500 second-feet. Gage height record not continuous due to imperfect operation of recorder. Mean daily gage heights obtained by inspecting recorder graph, or, for days of considerable fluctuation, by averaging the hourly gage heights. Daily discharge ascertained by indirect method for shifting control. Results fair.

Discharge measurements of Pecos River near Angeles, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	Gray and Hank........	0.88	614	Mar. 28	R. C. Thaxton.........	0.25	168
Nov. 9	R. J. Hank............	.45	259	May 23	R. J. Hank............	.35	174
Feb. 7	.....do................	.34	170	July 19	.....do................	.28	159

Daily discharge, in second-feet, of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	552	305	222	236	212	....	212	216	172	200	296	480
2	920	325	222	236	212	....	224	200	192	200	188	468
3	1,070	325	222	228	212	....	188	216	180	176	168	462
4	1,070	248	220	228	196	....	184	390	176	180	164	456
5	616	216	220	228	156	....	224	402	200	176	188	456
6	536	220	220	224	156	....	236	295	196	196	188	450
7	552	232	220	220	160	....	240	680	172	180	656	444
8	544	240	220	224	164	....	216	584	160	176	....	438
9	536	260	216	224	168	....	188	474	168	204	....	432
10	536	232	204	216	164	....	216	462	164	192	....	426
11	528	212	200	204	168	....	224	459	172	188	....	420
12	536	212	200	204	176	....	232	455	168	180	....	414
13	512	212	204	204	....	....	224	452	172	180	....	408
14	474	220	200	208	....	....	228	448	176	172	....	384
15	468	224	192	216	....	....	220	444	208	184	....	468
16	468	225	188	232	....	....	176	672	212	168	....	512
17	456	225	180	224	....	....	184	1,050	176	172	....	576
18	456	225	180	232	....	....	216	1,020	168	176	....	1,280
19	432	225	188	236	....	....	232	752	204	164	....	1,290
20	420	225	184	244	....	....	200	560	172	156	....	720
21	420	225	180	252	....	....	216	584	180	180	1,190	378
22	414	225	184	248	....	....	216	310	168	184	864	350
23	408	222	188	248	....	....	200	192	184	188	12,600	330
24	414	222	252	248	....	....	204	180	188	196	14,000	315
25	414	222	285	256	....	....	216	176	265	200	6,000	310
26	414	222	256	244	....	....	196	180	184	196	4,700	310
27	402	222	216	236	....	200	200	200	188	172	2,930	300
28	384	222	212	244	....	172	325	172	184	350	2,040	285
29	378	222	218	236	....	176	468	160	176	330	1,400	290
30	366	222	224	224	....	184	320	240	208	228	960	300
31	345	....	230	220	....	188	....	192	....	216	640	....

NOTE.—No gage-height record Nov. 16 to Dec. 7, Dec. 29-31, Feb. 13 to Mar. 26, May 11-14, Aug. 8-20, Aug. 24 to Sept. 2, and Sept. 4-12; discharge, except Feb. 13 to Mar. 26 and Aug. 8-20, estimated from record at Carlsbad and notes furnished by engineers.

Monthly discharge of Pecos River near Angeles, Tex., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,070	345	517	31,800
November	325	212	234	13,900
December	285	180	211	13,000
January	256	204	230	14,100
February 1-12	212	156	179	4,260
March 27-31	200	172	184	1,820
April	468	176	228	13,600
May	1,050	160	413	25,400
June	265	160	184	10,900
July	350	156	195	12,000
September	1,290	285	472	28,100

PECOS RIVER ABOVE BARSTOW, TEX.

Location.—Three-quarters of a mile below head gate of Biggs irrigation project, 1 mile east of Patrole siding on Pecos Valley Railway, 1¼ miles above head gate of Barstow Irrigation Co., 14 miles northwest of Barstow, Reeves County, 10 miles northwest of Pecos.

Drainage area.—Not measured.

Records available.—February 1, 1916, to September 30, 1916.

Gage.—Stevens water-stage recorder on right bank.

Discharge measurements.—Made by wading or from cable 150 feet below gage.

Channel and control.—Channel straight 100 feet above and 300 feet below station. Bed composed of gravel, clay, and sand; not permanent. Right bank is clay, clean, and fairly permanent; left bank loose sand covered with salt cedar; both banks are overflowed at gage height about 10 feet. Shoal 250 feet below gage serves as control; shifts during high water.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 12.1 feet at 6 a. m. August 10 (discharge not determined); minimum stage, 0.88 foot morning of July 10 (discharge, 36 second-feet).

Ice.—None reported during year.

Diversions.—In addition to the water stored and lands irrigated in New Mexico by the Carlsbad project of the United States Reclamation Service, some lands in Texas are irrigated just above the station. Considerable water is returned to the river by seepage below the reservoirs. The First Report of the Board of Water Engineers for the State of Texas shows that 26,200 acres were declared irrigated above the station, the quantity of water necessary, under an assumed duty of 2 feet, being 78,600 acre-feet.

Regulation.—Storage in connection with the Carlsbad project controls the run-off during parts of the year. The operation of a water-power plant of 300 horsepower capacity, below Carlsbad, does not affect the flow at this point.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined below 700 second-feet and poorly defined above. Mean daily gage height determined by inspecting the gage-height graph, or, for days of considerable fluctuation, by averaging the hourly gage height. Breaks in gage-height record caused by collections of silt in float box. Daily discharge ascertained by applying mean daily gage height to rating table, except from March 26 to May 13, and May 22 to August 23, when obtained by indirect method for shifting control. Determination of discharge during extremely high stages subject to error caused by water flowing over both banks. Results for periods during which water-stage recorder operated satisfactorily are good for low and medium stages and fair for high stages.

Discharge measurements of Pecos River above Barstow, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 1	R. J. Hank	2.30	194	Aug. 9	William Kessler	(a)	4,020
9	.....do	1.95	144	16	.....do	3.34	342
Mar. 26	R. C. Thaxton	1.39	94	17	.....do	3.81	546
May 25	R. J. Hank	2.66	392	24	.....do	9.89	3,120
July 16	.....do	1.05	49	Sept. 24	R. J. Hank	3.08	250

[a] Measurement made 4 miles above Pecos, gage height of 10.50 feet was determined from water-stage recorder chart.

Daily discharge, in second-feet, of Pecos River above Barstow, Tex., for the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	194	485	108	301	81	77	116	650
2	188	256	146	228	77	81	124	659
3	182	220	146	186	77	78	141	1,790
4	176	323	136	146	72	61	93	....
5	168	282	117	128	68	46	77	....
6	162	232	99	147	67	47	73	....
7	156	184	113	248	68	49	80	....
8	150	170	131	252	71	41	542	....
9	144	231	131	359	81	37	3,230	....
10	....	165	127	483	77	39	3,960	....
11	....	259	99	323	78	45	2,100	....
12	....	178	98	343	75	54	1,260	....
13	....	174	106	218	75	41	916	....
14	....	171	118	220	90	41	596	....
15	....	167	119	220	178	50	423	....
16	....	166	98	220	122	51	357	....
17	....	164	112	500	86	59	578	....
18	....	162	96	800	80	76	772	....
19	....	155	86	750	79	63	638	....
20	....	145	80	500	78	73	510	....
21	....	136	85	400	73	65	876	....
22	....	127	93	325	72	54	1,260	....
23	....	118	93	259	72	55	884	....
24	....	109	95	401	77	67	2,140	249
25	....	100	96	426	81	67	2,560	231
26	....	92	93	332	82	66	3,070	210
27	....	85	94	278	100	69	3,020	207
28	....	93	97	216	96	78	2,860	199
29	....	95	93	161	84	124	2,000	182
30	....	89	140	138	79	231	820	181
31	....	84	....	105	....	177	650	....

NOTE.—Discharge computed by indirect method for shifting control Mar. 26 to May 13 and May 22 to Aug. 23. No gage height record obtained for Feb. 2–8, 10–29, Mar. 19–25, May 14–21, and Sept. 4–23. Discharge Feb. 2–8, Mar. 19–25, and May 14–21 estimated by comparison with records at other stations. Discharge not estimated for Feb. 10–29 and Sept. 4–23. Maximum gage height Sept. 19 was 6.70 feet.

Monthly discharge of Pecos River above Barstow, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February 1–9	194	144	169	3,020
March	485	84	175	10,800
April	146	80	108	6,430
May	800	105	310	19,100
June	178	67	83.2	4,950
July	231	37	69.7	4,290
August	3,960	73	1,180	72,600

PECOS RIVER NEAR GRANDFALLS, TEX.

Location.—At highway bridge on Grandfalls-Fort Stockton road, 3 miles south of Grandfalls, on line between Ward and Pecos counties, 3 miles above diversion dam of the Zimmerman irrigation project, 3½ miles below diversion dam for silt-line canal of the Imperial Irrigation Co., 21 miles south of Monahans.

Drainage area.—Not measured.

Records available.—November 6, 1915, to September 30, 1916.

Gage.—Stevens water-stage recorder attached to downstream side of middle pier of highway bridge.

Discharge measurements.—Made by wading 200 feet below gage or from highway bridge.

Channel and control.—Bed composed of gravel and rock. Channel straight above and below station for 200 feet. Right bank is rock, medium in height, and subject to overflow during extreme stages; left bank sandy, high, clean and not subject to overflow. Shoal 200 feet below serves as control for low and medium stages but is likely to shift; position of high-water control not known.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 12.8 feet at 8 a. m. August 29 discharge, 4,370 second-feet; result obtained from extension of rating curve and possibly considerably in error; minimum stage, 0.38 foot 1 a. m. April 17 (discharge not determined).

Ice.—None reported during year.

Diversions.—Station is 3½ miles below diversion of silt-line canal of Imperial Irrigation Co., 20 miles below diversion for the Imperial reservoir (capacity 17,000 acre-feet), 17 miles below diversion for Grandfalls project, and 3 miles above diversion for Zimmerman project. Available data show that tracts aggregating approximately 143,000 acres are irrigable between station and lower limits of Carlsbad project of United States Reclamation Service. First Report of Board of Water Engineers for the State of Texas shows total number of acres declared irrigated in Texas above the station to be 57,300, the amount of water required under an assumed duty of 2 acre-feet per acre, being 171,900 acre-feet. The effect of diversions is somewhat counterbalanced by water returned to stream by seepage.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined below 3,200 second-feet. Gage-height record somewhat fragmentary due to stoppage of water-stage recorder. Mean daily gage heights obtained by inspecting gage-height graph, or, for days of considerable fluctuation, by use of planimeter. Daily discharge ascertained by applying mean daily gage heights to rating table except for periods during which stage-discharge relation was affected by shifting control. Results fair.

Discharge measurements of Pecos River near Grandfalls, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	R. J. Hank	2.38	68.6	Aug. 12	William Kessler	9.92	2,580
Feb. 3	.....do	2.28	27.2	13	.....do	10.52	2,270
Mar. 30	R. C. Thaxton	.95	9.2	13	.....do	8.74	1,860
May 26	R. J. Hank	1.00	12.3	13	.....do	7.58	1,410
July 21	.....do	1.18	19.5	14	.....do	5.34	740
Aug. 11	Watrous and Sullivan	9.08	2,410	23	.....do	5.07	677
12	William Kessler	9.64	2,470	Sept. 23	R. J. Hank	3.94	311

Daily discharge, in second-feet, of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	77	170	28	31	8.6	73	7.2	10	32	730
2	....	99	170	25	73	8.0	78	6.8	9.8	33	610
3	....	114	170	26	74	7.4	79	7.6	9.6	36	760
4	....	120	170	23	31	7.8	44	8.2	11	39	1,310
5	....	132	170	20	19	8.4	27	7.4	12	41	1,260
6	88	147	170	24	16	9.6	34	7.0	11	40	1,690
7	72	147	172	25	15	10	42	7.6	11	42	1,720
8	63	146	169	25	14	9.8	49	8.0	12	45	1,600
9	60	146	166	26	14	9.8	63	8.2	12	65	1,080
10	58	145	163	22	13	10	74	8.6	11	1,290	915
11	54	....	160	35	13	10	82	8.2	11	1,960	855
12	49	....	159	48	14	9.2	85	8.0	12	2,400	825
13	50	....	158	61	13	10	86	8.0	12	2,180	735
14	50	....	157	56	14	10	78	8.0	13	711	645
15	49	....	133	51	13	8.4	80	8.0	15	495	585
16	47	....	119	46	11	1.0	82	8.4	16	445	555
17	47	....	85	41	12	.7	85	8.8	18	420	525
18	44	....	61	36	14	5.0	76	8.8	20	555	495
19	42	....	54	31	14	9.4	68	8.8	20	735	420
20	64	....	37	31	12	12	183	8.8	20	585	445
21	68	....	20	32	12	12	68	9.4	20	445	513
22	85	....	20	33	11	12	83	9.8	20	445	765
23	93	....	21	34	11	10	41	11	21	621	372
24	94	....	21	35	10	12	22	11	21	516	235
25	78	....	26	36	10	12	18	11	21	1,230	160
26	78	....	32	36	10	12	12	11	22	2,050	122
27	78	....	38	35	10	14	10	11	23	2,900	100
28	80	....	43	33	10	26	9.4	10	23	4,020	81
29	82	....	41	32	10	42	8.6	10	25	4,180	72
30	82	....	36	....	8.6	59	8.8	10	27	3,910	63
31	....	....	31	....	10	....	8.0	....	29	1,850	....

NOTE.—Discharge computed by indirect method for shifting control Dec. 11 to May 3 and July 14 to Aug. 8. No gage-height record Dec. 7–9, Dec. 11 to Jan. 6, Jan. 9, 10, 12, 13, 15–17, 19, 20, 22, 23, 25–27, 30, Feb. 1, 11, 12, 14–18, 20–25, and 27–29, May 6, 7, Sept. 1–3, 5 and 9–18; discharge for these days, except Dec. 11–31, estimated or interpolated.

Monthly discharge of Pecos River near Grandfalls, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 6-30	94	42	66.2	3,280
December 1-10	147	77	127	2,520
January	172	20	101	6,150
February	61	20	34.0	1,960
March	74	8.6	17.5	1,080
April	59	.7	12.5	744
May	183	8.0	56.7	3,490
June	11	6.8	8.82	525
July	29	9.6	16.7	1,030
August	4,180	32	1,090	67,000
September	1,720	63	675	40,200

PECOS RIVER NEAR COMSTOCK, TEX.[1]

Location.—At the Pecos high bridge of the Galveston, Harrisburg & San Antonio Railway Co., 11 miles west of Comstock, Val Verde County, 18 miles east of Langtry, 14 miles by stream above confluence with Rio Grande, and below all tributaries.

Drainage area.—Not measured.

Records available.—May 1, 1900, to September 30, 1916 (also gage heights for 1898).

Gage.—Vertical staff attached to the downstream side of bridge pier on left bank; read by W. A. Clare.

Discharge measurements.—Made from cable 1,000 feet above bridge.

Channel and control.—Banks and stream bed composed of rock and gravel; water flows through a series of rapids and pools in a canyon approximately 300 feet deep; banks are not subject to overflow. Stage-discharge relation at the lower stages changes slightly.

Extremes of discharge.—Maximum stage recorded during year, 33.0 feet at 10 p. m. September 1 (discharge not determined); minimum stage, 0.30 foot from 6 p. m. June 24 to 6 p. m. June 25 (discharge, 205 second-feet).

1900–1916: Maximum stage recorded, 35.75 feet April 6, 1900 (discharge not determined); minimum discharge recorded, 110 second-feet May 13, 14, 1904 (gage height, 0.5 foot).

Ice.—None reported during year.

Diversions.—Considerable water is diverted and stored above the station for irrigation. Lake McMillan and Lake Avalon, of the Carlsbad project of the United States Reclamation Service, with a combined capacity of 58,500 acre-feet, are on Pecos River a few miles above Carlsbad, N. Mex. In addition to the water stored in New Mexico, water from Pecos River is used to irrigate large areas of land in the vicinity of Barstow and Grandfalls, Tex. There are no diversions below the station. Return waters tend to equalize effects of diversions in lower part of drainage basin.

Regulation.—Yearly run-off at this point controlled by storage and diversions for irrigation above station. No water-power plants operated in the drainage basin, except a public utility plant of about 300 horsepower, near Carlsbad, N. Mex, which does not control the flow at this point.

Accuracy.—Stage-discharge relation subject to slight changes. Gage read to hundredths twice daily; mean of two readings may not be a true index of mean daily discharge. Rating curve well defined between 200 and 4,000 second-feet. Daily discharge ascertained by applying mean daily gage heights to rating table except during periods for which the stage-discharge relation is affected by shifting control. Results fair.

Discharge measurements of Pecos River near Comstock, Tex., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	W. C. Dodd	1.10	484	Apr. 18	W. C. Dodd	.58	292
24	do	.90	377	May 18	do	.48	263
Dec. 11	do	.90	422	June 17	do	.32	212
22	Thaxton and Dodd	1.05	473	July 18	do	.48	253
Jan. 15	W. C. Dodd	1.00	524	Aug 12	do	.32	208
Feb. 18	do	.75	343	18	do	1.55	783
Mar. 18	Thaxton and Dodd	.62	304	Sept. 2	do	5.18	4,500

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[1] Published in earlier reports as Pecos River near Moorhead, Tex.

Daily discharge, in second-feet, of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,330	709	384	438	370	323	320	280	247	211	265	8,010
2	1,310	709	374	438	362	302	465	283	241	211	241	14,800
3	1,750	709	374	460	350	312	323	283	241	211	235	2,560
4	1,310	679	406	438	350	295	316	283	241	211	229	1,610
5	739	649	406	420	370	312	320	283	241	214	229	1,200
6	838	619	410	495	350	295	316	280	241	217	229	1,010
7	804	589	420	465	350	302	316	280	235	217	226	866
8	908	589	438	456	350	312	316	280	235	229	223	679
9	804	589	424	460	350	312	320	280	235	232	226	1,470
10	943	589	438	442	350	312	316	280	235	235	226	1,730
11	873	532	424	446	330	312	316	277	235	268	223	1,840
12	804	480	460	475	330	312	316	277	238	241	214	1,590
13	739	480	438	480	330	302	316	280	235	235	211	1,800
14	739	619	438	470	330	302	316	280	235	235	220	1,350
15	838	589	438	465	330	312	316	277	235	241	1,280	950
16	804	526	485	521	330	312	316	280	235	247	1,550	845
17	771	554	460	490	330	312	316	271	220	253	1,670	915
18	804	470	438	485	338	316	295	262	211	259	790	880
19	1,230	438	424	505	350	309	289	259	211	253	950	845
20	838	420	438	475	350	312	295	456	211	247	845	697
21	804	379	438	446	330	306	292	280	205	804	625	697
22	771	370	460	490	312	306	289	280	208	262	560	715
23	649	358	460	460	330	312	289	271	211	289	500	679
24	771	370	438	442	330	306	289	259	208	271	465	758
25	771	379	438	428	330	312	283	256	205	262	470	1,010
26	771	392	438	402	330	309	280	253	211	244	456	894
27	739	384	470	397	323	302	277	253	211	238	532	733
28	709	388	451	392	312	295	280	259	211	235	739	625
29	709	379	424	370	323	306	280	259	211	235	1,310	613
30	649	370	424	370	......	302	274	259	211	238	2,000	543
31	709	......	460	370	......	295	......	253	......	268	2,240	......

NOTE.—Discharge computed by indirect method for shifting control Oct. 1 to Dec. 7 and Jan. 5–27.

Monthly discharge of Pecos River near Comstock, Tex., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,750	649	878	54,000
November	709	358	510	30,300
December	485	374	433	26,600
January	521	370	448	27,500
February	370	312	339	19,500
March	323	295	307	18,900
April	465	274	308	18,300
May	456	253	278	17,100
June	247	205	225	13,400
July	804	211	258	15,900
August	2,240	211	651	40,000
September	14,800	543	1,760	105,000
The year	14,800	205	532	386,000

Days of deficiency in discharge of Pecos River near Comstock, Tex., for the years ending Sept. 30, 1901–1916.

Discharge in second-feet.	Days of deficient discharge.							
	1900–1901	1901–2	1902–3	1903–4	1904–5	1905–6	1906–7	1907–8
100	....	....	....	....	....	....	....	....
150	....	....	....	45	....	....	....	....
200	19	....	5	130	....	....	3	....
250	29	20	59	256	....	....	33	12
300	73	57	109	291	....	....	81	17
350	88	81	125	305	....	....	83	63
400	114	108	150	306	....	....	115	101
450	143	127	232	306	....	16	175	128
500	185	165	269	309	....	39	200	158
600	251	208	333	317	18	98	316	186
700	280	256	339	326	47	188	329	222
800	299	273	345	334	107	255	361	258
900	306	290	348	344	162	320	365	293
1,000	313	307	350	344	176	325	....	313
1,200	330	326	350	346	211	336	....	330
1,500	345	338	352	352	247	354	....	350
1,800	352	345	352	354	290	356	....	355
2,200	360	353	365	357	315	359	....	355
2,600	363	360	....	357	328	359	....	359
3,000	363	364	....	358	338	359	....	364
3,500	363	364	....	361	342	359	....	364
4,000	363	364	....	361	345	359	....	364
5,000	364	364	....	362	355	361	....	364
7,000	364	364	....	362	362	361	....	364
10,000	365	364	....	362	364	362	....	365
15,000	....	364	....	365	365	362	....	366
20,000	....	364	....	366	....	363	....	....
25,000	....	365	....	....	....	363	....	....
30,000	....	....	....	....	....	364	....	....
35,000	....	....	....	....	....	364	....	....
37,000	....	....	....	....	....	365	....	....

Discharge in second-feet.	Days of deficient discharge.							
	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16
100	....	....	....	....	....	....	....	....
150	....	....	....	54	10	....	....	....
200	19	78	21	129	68	....	....	....
250	82	123	128	187	150	18	....	65
300	157	238	217	325	214	91	....	121
350	212	309	264	363	265	130	....	181
400	293	345	295	365	283	151	28	211
450	334	350	310	365	299	193	57	243
500	338	352	321	265	305	216	76	273
600	344	353	331	365	316	239	141	287
700	348	354	336	365	325	272	193	300
800	350	357	340	365	331	285	240	320
900	352	358	343	365	335	297	281	337
1,000	354	358	345	365	339	310	290	342
1,200	358	359	347	366	346	322	303	344
1,500	362	363	353	....	352	331	321	353
1,800	365	364	356	....	353	339	331	359
2,200	....	364	358	....	357	347	333	362
2,600	....	364	363	....	359	352	337	364
3,000	....	364	363	....	359	353	344	364
3,500	....	364	363	....	359	355	346	364
4,000	....	364	364	....	360	356	350	364
5,000	....	364	364	....	361	360	354	364
7,000	....	364	364	....	362	361	361	364
10,000	....	364	364	....	362	365	362	365
15,000	....	364	365	....	362	....	363	365
20,000	....	364	....	....	365	....	363	....
25,000	....	364	....	....	....	....	363	....
30,000	....	365	....	....	....	....	364	....
35,000	....	....	....	....	....	....	364	....
37,000	....	....	....	....	....	....	365	....

MISCELLANEOUS MEASUREMENTS.

Miscellaneous discharge measurements in Texas during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 29	Colorado River	Gulf of Mexico	Austin dam, Tex		231
31	do	do	do		179
Sept. 2	do	do	do		157
6	do	do	do		109
Aug. 29	Barton Creek	Colorado River	½ mile above mouth, 2 miles southwest of Austin.		32.9
31	do	do	do		30.5
Sept. 2	do	do	do		30.1
6	do	do	do		28.2
Aug. 13	Imperial Reservoir intake.	Diverts from Pecos River.	3 miles south of Grandfalls.		322

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STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART VIII. WESTERN GULF OF MEXICO DRAINAGE BASINS

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, and annual reports, and monographs.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific basins in California.
XII. North Pacific basins (in three volumes).

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500, Customhouse.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., Capitol Building, care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,100 points in the United States, and the data obtained have been published in the reports tabulated below:

Steam-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	.....do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte,and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	....do	1903.
W 124 to 135	....do	1904.
W 165 to 178	....do	1905.
W 201 to 214	....do	1906.
W 241 to 252	....do	1907–8.
W 261 to 272	....do	1909.
W 281 to 292	....do	1910.
W 301 to 312	....do	1911.
W 321 to 332	....do	1912.
W 351 to 362	....do	1913.
W 381 to 394	....do	1914.
W 401 to 414	....do	1915.
W 431 to 444	....do	1916.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The table below gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1913. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1913, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page III, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

Numbers of water-supply papers containing results of stream measurements, 1899–1916.

Year.	North Atlantic coast (St. John River to York River).	South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi).	Ohio River.	St. Lawrence River and Great Lakes.	Hudson Bay and upper Mississippi River.	Missouri River.	Lower Mississippi River.	Western Gulf of Mexico.	Colorado River.	Great Basin.	Pacific coast in California.	North Pacific drainage basins.		
												Pacific basins in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific basins in Oregon.
1899[a]	35	[b] 35,36	36	36	36	[i] 36,37	37	37	[d] 37,38	38, [e] 39	38, [f] 39	38	38	38
1900[g]	47, [h] 48	48	48, [c] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65,75	65,75	65,75	65,75	[k] 65,66,75	66,75	[k] 65,66,75	66,75	66,75	66,75	66,75	66,75	66,75	66,75
1902	82	[b] 82,83	84	[l] 82,83	[k] 83,85	84	[k] 83,84	84	85	85	85	85	85	85
1903	97	[b] 97,98	98	97	[k] 98,99,[m] 100	99	[k] 98.99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126,127	128	129	[k] 128,130	130, [q] 131	[k] 128,131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165. [o] 166, [p] 167	[p] 167,168	169	170	171	172	[k] 169,173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177,178
1906	[n] 201, [o] 202, [p] 203	[p] 203,204	205	206	207	208	[k] 205,209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	415
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Estimates for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Scioto River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific coast basin.

[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Estimates for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Gallatin River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England Rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

PART VIII. WESTERN GULF OF MEXICO DRAINAGE BASINS.

PRINCIPAL STREAMS.

The western Gulf of Mexico drainage basins include all streams draining into the Gulf of Mexico west of the mouth of the Mississippi and into the Rio Grande. The largest streams flowing into the Gulf of Mexico north of the mouth of the Rio Grande are Sabine, Trinity, and Brazos rivers, Colorado River of Texas, and Guadalupe River. The principal tributaries of the Rio Grande are Chama River, Rio Puerco, and Pecos River in the United States and Rio Salado and Rio San Juan in Mexico. The streams drain wholly or in part the States of Colorado, Louisiana, New Mexico, Texas, and northern States of Mexico.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. XVII.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1916; period after a date indicates discontinuance. Tributaries are indicated by indention.

SABINE RIVER BASIN.

Sabine River near Longview, Tex., 1904–1906.
Sabine River at Logansport, La., 1903–1906.
    Neches River at Evadale, Tex., 1904–1906.

TRINITY RIVER BASIN.

Trinity River at Bridgeport, Tex., 1915–
Trinity River at Dallas, Tex., 1898–99; 1903–1906.
Trinity River at Riverside, Tex., 1903–1906.

BRAZOS RIVER BASIN.

Brazos River near Graham, Tex., 1915–
Brazos River at Brazos, Tex., 1914–
Brazos River at Waco, Tex., 1898–1911; 1914–
Brazos River near Lewis (Hearne), Tex., 1898–99.
Brazos River at Richmond, Tex., 1903–1906.
Clear Fork of Brazos River near Eliasville, Tex., 1915–

COLORADO RIVER (OF TEXAS) BASIN.

Colorado River near Bronte, Tex., 1915–
Colorado River at Ballinger, Tex., 1915–
Colorado River near Chadwick, Tex., 1915–

Colorado River at Austin, Tex., 1895–1911; 1914–
Evaporation near Austin, Tex., 1916–
Colorado River at Columbus, Tex., 1903–1911; 1916–
    North Concho River at San Angelo, Tex., 1915–
    Concho River near San Angelo, Tex., 1915–
    Concho River near Paint Rock, Tex., 1915–
    San Saba River at Menard, Tex., 1915–
    San Saba River near San Saba, Tex., 1905–6; 1915–
    North Llano River near Junction, Tex., 1915–
    Llano River near Junction, Tex., 1915–

GUADALUPE RIVER BASIN.

Guadalupe River near New Braunfels, Tex., 1898–99; 1915–
Guadalupe River near Gonzales, Tex., 1915–
Guadalupe River near Cuero, Tex., 1903–1906; 1915–
Guadalupe River below Cuero, Tex., 1916–
    San Marcos River at San Marcos, Tex., 1915–
    San Marcos River at Ottine, Tex., 1915–

SAN ANTONIO RIVER BASIN.

San Antonio River at San Antonio, Tex., 1915–
    San Pedro Creek at San Antonio, Tex., 1916–

NUECES RIVER BASIN.

Nueces River near Cinonia, Tex., 1915–
    Nueces River near Cotulla, Tex., 1915–
    Nueces River near Three Rivers, Tex., 1915–
    Nueces River at Calallen, Tex., 1915–
        Frio River near Derby, Tex., 1915–
        Frio River at Fowlerton, Tex., 1915–
        Frio River at Three Rivers, Tex., 1915.
            Frio Lake outlet near Fowlerton, Tex., 1915–

RIO GRANDE BASIN.

Rio Grande at Thirtymile Bridge near Creede, Colo., 1909–1913.
Rio Grande near Creede (Wason), Colo., 1907–1913.
Rio Grande near Del Norte, Colo., 1889–1906; 1908–1913.
Rio Grande near Alamosa, Colo., 1894–95; 1903; 1912–13.
Rio Grande near Lobatos (Cenicero), Colo., 1899–1913.
Rio Grande at Embudo, N. Mex., 1899–1903; 1912–
Rio Grande near Buckman, N. Mex. (Rio Grande near Ildefonso), 1895–1905; 1909–1914.
Rio Grande near San Marcial, N. Mex., 1895–
Rio Grande near El Paso, Tex., 1889–1893; 1895–1915.
Rio Grande near Fort Hancock, Tex., 1900–1903.
Rio Grande above Presidio, Tex., 1900–1914.
Rio Grande below Presidio, Tex., 1900–1915.
Rio Grande near Langtry, Tex., 1900–1914.
Rio Grande near Devils River, Tex., 1900–1915.
Rio Grande at Eagle Pass, Tex., 1900–1916.
Rio Grande near Laredo, Tex., 1900–1914.
Rio Grande near Roma, Tex., 1900–1914.
Rio Grande near Brownsville, Tex., 1900–1914.
    Clear Creek near Creede, Colo., 1910.

Rio Grande tributaries—Continued.
- South Fork of Rio Grande at South Fork, Colo., 1910–1913.
- San Luis Creek at Villa Grove, Colo., 1911–12.
- San Luis Creek near Villa Grove, Colo., 1910.
    - Kerber Creek near Villa Grove, Colo., 1911–12.
    - Saguache Creek near Saguache, Colo., 1910–1913.
- Rio Alamosa near Monte Vista, Colo., 1911–12.
- Rio Alamosa near La Jara, Colo., 1909–1912.
- Conejos River near Mogote, Colo., 1899–1900; 1903–1913.
    - Rio San Antonio near Ortiz, Colo., 1911.
- Culebra River at San Luis, Colo., 1910–11.
- Costilla Creek near mouth, N. Mex., 1912.
- Rio Colorado above Questa, N. Mex., 1910–1911.
- Rio Colorado near Questa, N. Mex., 1912–1915.
- Rio Colorado below Questa, N. Mex., 1910–1915.
- Rio Hondo near Arroyo Hondo, N. Mex., 1910–1915.
- Rio Pueblo de Taos near Taos, N. Mex., 1910–1916.
- Rio Taos at Los Cordovas, N. Mex., 1910–1915.
    - Rio Lucero near Taos, N. Mex., 1910–1916.
    - Rio Fernando de Taos near Taos, N. Mex., 1910; 1912–1915.
- Chama River at Chama, N. Mex., 1912–1914.
- Chama River near Chama, N. Mex., 1914–
- Chama River at Park View, N. Mex., 1912–1916.
- Chama River near El Vado [Tierra Amarilla], N. Mex., 1913–
- Chama River at Abiquiu, N. Mex., 1895–1897.
- Chama River near Chamita, N. Mex., 1912–1915.
    - Brazos River near Brazos, N. Mex., 1913–
    - Brazos River at Brazos, N. Mex., 1912–13.
        - Little Brazos River near Brazos, N. Mex., 1914.
    - Nutritus Creek near El Vado [Tierra Amarilla], N. Mex., 1914–
    - Nutrias Creek near Cebolla, N. Mex., 1914.
    - Horn River near Canjilon, N. Mex., 1911–1914.
    - Rio Vallecitos at Vallecitos, N. Mex., 1911–1914.
- Santa Fe Creek at Monument Rock, near Santa Fe, N. Mex., 1910–11.
- Santa Fe Creek above reservoir, near Santa Fe, N. Mex., 1910; 1913–14.
- Santa Fe Creek at Santa Fe, N. Mex., 1907–1911.
    - Santa Fe Water & Light Co. ditch near Santa Fe, N. Mex., 1910.
    - Arroyo Hondo near Santa Fe, N. Mex., 1913–14.
- Rio Puerco at Rio Puerco, N. Mex., 1910–1914.
- Rio Puerco near La Joya, N. Mex., 1910–1914.
    - Bluewater Creek (head of San Jose River) near Bluewater, N. Mex., 1912–1914.
    - Bluewater Creek at Grants, N. Mex., 1912–1914.
    - San Jose River near Suwanee, N. Mex., 1910–1914.
- Pecos River near Cowles, N. Mex., 1910–1914.
- Pecos River near Anton Chico, N. Mex., 1910–1914.
- Pecos River at Santa Rosa, N. Mex., 1903–1906; 1910–11; 1912–1914.
- Pecos River near Guadalupe, N. Mex., 1912–1914.
- Pecos River near Fort Sumner, N. Mex., 1904–1910; 1912–13.
- Pecos River near Roswell, N. Mex., 1903–1906.
- Pecos River near Dayton, N. Mex., 1905–
    - Lake McMillan at Lakewood, N. Mex., 1906–7.
- Pecos River near Lakewood, N. Mex., 1906–1911.
- Pecos River at Avalon, N. Mex., 1906–7.
- Pecos River at Carlsbad, N. Mex., 1903–1908; 1914–

Rio Grande tributaries—Continued.
  Evaporation near Carlsbad, N. Mex., 1916-
  Pecos River near Angeles, Tex., 1914-
  Pecos River above Barstow, Tex., 1916-
  Pecos River near Pecos, Tex., 1898-1907.
  Pecos River near Barstow, Tex., 1914-15.
  Pecos River near Grand Falls, Tex., 1915-
  Pecos River near Comstock [Moorhead], Tex., 1898; 1900-
    Gallinas River near Las Vegas, N. Mex., 1903-1912; 1912-1914.
      South Fork of Gallinas River near El Porvenir, N. Mex., 1911-1914.
    Hondo River at Hondo reservoir, N. Mex., 1903-1906.
    Hondo River at Roswell, N. Mex., 1903-1906.
      Rio Ruidoso near Ruidoso, N. Mex., 1911.
      Rio Ruidoso near Glencoe, N. Mex., 1910-11.
      Taylor-Moore ditch near Roswell, N. Mex., 1905.
    Hondo reservoir inlet near Roswell, N. Mex., 1906-1908.
    Hondo reservoir scour gate near Hondo reservoir, N. Mex., 1906.
    Penasco River at Elk, N. Mex., 1900-11.
    Penasco River at Cleve's ranch, near Elk, N. Mex., 1911.
    Penasco River near Dayton, N. Mex., 1905-1908.
    Black River near Malaga, N. Mex., 1914-15.
    Delaware River near Malaga, N. Mex., 1912-13.
    Delaware River near Angeles, Tex., 1914-15.
    Marguerretta flume near Pecos, Tex., 1898; 1900-1907.
    West Valley ditch near Pecos, Tex., 1904.
  Devils River at Devils River, Tex., 1900-1914.
  Rio Salado near Guerrero, Tamaulipas, Mexico, 1900-1913.
  Rio San Juan at La Quemada, Tamaulipas, Mexico, 1900-1902.
  Rio San Juan near Santa Rosalia ranch, Tamaulipas, Mexico, 1902-1914.

INTERIOR BASINS IN NEW MEXICO.

Mimbres River basin:
  Mimbres River near Faywood, N. Mex., 1908-1914.
  Lampbright Draw near Santa Rita, N. Mex., 1912-1914.
  Whitewater Creek near Hurley, N. Mex., 1913-14.
  Cameron Creek at Fort Bayard, N. Mex., 1907-1911; 1912-13.
  Cameron Creek near Hurley, N. Mex., 1913-14.
    Stevens Creek near Fort Bayard, N. Mex., 1907-1911; 1912-1914.
    Rio de Arena near Hurley, N. Mex., 1913-14.
Rio Tularosa basin:
  Rio Tularosa at Mescalero, N. Mex., 1910-11.
  Rio Tularosa near Bent, N. Mex., 1911.
  Rio Tularosa near Tularosa, N. Mex., 1912-
Rio La Luz basin:
  Rio La Luz near La Luz, N. Mex., 1911-12.
  Rio La Luz at La Luz, N. Mex., 1910-1913.
    Rio Fresnal near Mountain Park, N. Mex., 1911-12.

REPORTS ON WATER RESOURCES OF THE WESTERN GULF STATES.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*10. Irrigation in Mesilla Valley, N. Mex., by F. C. Barker. 1898. 51 pp., 11 pls. 10c.

Describes primitive methods of irrigation and agriculture employed in an area lying along both sides of the Rio Grande, extending from Fort Seldon, N. Mex., on the north, to within 3 miles of El Paso on the south. Chiefly of historic interest.

*13. Irrigation systems in Texas, by W. F. Hutson. 1898. 68 pp., 10 pls.

Discusses climate, rainfall, irrigation works and projects in Texas; considers use of both surface and underground waters.

*40. The Austin dam, by T. U. Taylor. 1900. 52 pp., 16 pls. 15c.

Describes preliminary projects, construction, economic aspect, and failure of the dam across Colorado River.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

71. Irrigation systems of Texas, by T. U. Taylor. 1902. 137 pp., 9 pls. 10c.

Discusses principal irrigation systems in geographic order and gives statistics as to the location, cost, and benefits of the devices for obtaining water; describes rice irrigation systems, and appends a brief statement of laws governing irrigation in the State.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses drainage and irrigation and gives records of stream flow.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.]

Contains "Investigations in Pecos Valley," by W. M. Reed.

101. Underground waters of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping, and treats briefly of rice cultivation.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams.

114. Underground waters of eastern United States, by M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief report on Louisiana and southern Arkansas; discusses the geologic formation as related to water supply; gives a list of the principal publications.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Contains a chapter giving results of tests of typical pumping plants in the Rio Grande valley in Texas and New Mexico.

141. Observations on the ground waters of the Rio Grande valley, by C. S. Slichter. 1905. 83 pp., 5 pls. 5c.

Describes investigation of the underflow in the valley of the Rio Grande in Texas and New Mexico, gives details of tests of pumping plants near El Paso, Tex., in Mesilla Valley, N. Mex., and near Berino, N. Mex., and analyses of well waters and data concerning wells at and near El Paso.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Pecos River basin flood, New Mexico, from report of Frank S. Dobson.
Failures of Lake Avalon dam near Carlsbad, N. Mex., by E. C. Murphy.
Rio Grande floods, New Mexico, by E. C. Murphy.

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives, by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

158. Preliminary report on the geology and underground waters of the Roswell artesian area, New Mexico, by C. A. Fisher. 1906. 29 pp., 9 pls. 15c.

Discusses topography and geology of a belt lying along Pecos River from Roswell to Lake McMillan; discusses area and extent of artesian basins, source, amount, pressure, quality (with analyses), and waste of artesian waters, and irrigation; lists typical wells and gives well records.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods on Pecos and Hondo rivers and the Rio Grande, and estimates of flood frequency and discharge for Rio Grande at San Marcial, N. Mex., and Colorado River (of Texas) at Austin; contains also index to literature on floods in American streams.

*188. Water resources of the Rio Grande valley in New Mexico, and their development, by W. T. Lee. 1907. 59 pp., 10 pls. 20c.

Describes the physical features of the valley, rock formation and structure, the Engle, San Acaci, San Felipe, and Espanola reservoir sites, surface and underground waters by districts, the origin, course, and quantity of the underflow, the chemical character of the water in the Mesilla and other districts, and the utilization of the underflow by wells and seepage ditches.

*190. Underground waters of Coastal Plain of Texas, by Thomas U. Taylor. 1907. 73 pp., 3 pls. 15c.

Describes topography, drainage, and geology, and discusses the underground waters by counties; gives many well records and analyses.

236. The quality of surface waters in the United States: Part I.—Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Brazos and Colorado (of Texas) rivers and the Rio Grande.

240. Geology and water resources of the San Luis Valley, Colorado, by C. E. Siebenthal. 1910. 128 pp., 13 pls. 25c.

Describes the topography, drainage, climate, geologic features, flowing and nonflowing wells, springs, the grouping of wells, and variations in flow and temperature, and the quality (with analyses) and uses of the water; discusses briefly well-drilling methods and costs, and approximate measurements of flows.

260. Preliminary report on the ground waters of Estancia Valley, New Mexico, by O. E. Meinzer. 1910. 33 pp. 5c. (See Water-Supply Paper 275.)

Discusses briefly the geographic relation and industrial development, geology, and soils; discusses the source, disposal, recovery, quality, and utilization of the ground waters, cost of pumping, windmills, value of crops, and the alkali problem.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

275. Geology and water resources of Estancia Valley, New Mexico, with notes on ground-water conditions in adjacent parts of central New Mexico, by O. E. Meinzer. 1911. 89 pp., 14 pls. 20c.

Describes physiographic features and geologic formations, soils and climate; discusses the source and disposal of the water supply, the head of the water supply, artesian conditions, yield of wells and quantity of water available, the quality of the water (dissolved solids, chlorine, sulphates, carbonates, and bicarbonates), the storage of storm water, the present and future use of ground water for irrigation, proper types of wells, windmills, cost of pumping, value of crops; and the alkali problem; tables give depths to water and field assays. Contains also briefs reports on physiography, geology, soil, ground water, and irrigation in Encino and Pinos Wells basins.

317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls. 10c.

Describes the physiography, climate, surface, and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

*335. Geology and underground waters of the southeastern part of the Texas Coastal Plain, by Alexander Deussen. 1914. 365 pp., 9 pls. 55c.

Describes an area lying east of Brazos River and south of a line extending east and west through Jefferson, in Marion County; discusses the underground-water horizons of the region and the artesian conditions and prospects in the several counties; gives well sections and tabulated details of the wells.

343. Geology and water resources of Tularosa Basin, New Mexico, by O. E. Meinzer and R. F. Hare. 1915. 317 pp., 19 pls. 40c.

Describes a closed basin lying between the Pecos and the Rio Grande; gives an account of the climate, history of previous investigations and literature, and industrial development; discusses the physiography and drainage, rocks, sources of the underground water, yield of wells, and quality of the waters in the various formations; suggests methods of drilling, boring, digging, casing, and finishing wells; discusses also soil and native vegetation in relation to water supply, irrigation from streams, springs, flood waters, and wells, and railroad and public water supplies; gives detailed information in regard to watering places on routes of travel.

*345. Contributions to the hydrology of the United States. 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(c) Underground water of Luna County, N. Mex., by N. H. Darton, with results of pumping tests, by A. T. Schwennesen, pp. 25–40.

Describes briefly the extent and thickness of the water-bearing beds underlying the wide bolsons of Luna County, the source and quality of the underground waters, the wells in the region about Deming, Iola, Waterloo, Columbus, and Myndus in the Carne region, lower Mimbres Valley, the region west of Red Mountain, and other parts of the county; discusses the depletion of supply by the pumping plants. The pumping tests were made at plants representing average types.

358. Water resources of the Rio Grande basin, 1888–1913, by Robert Follansbee and H. J. Dean, including surface water supply of the western Gulf of Mexico basins, 1913, by Robert Follansbee, W. W. Follett, and G. A. Gray. 1915. 725 pp., 3 pls. 50c.

Describes the general features of the Rio Grande basin and the closed basins lying between the Rio Grande and the Pecos, west of the Rio Grande, and in Mexico; discusses the distribution of precipitation, forestation, and population. Contains "not only all data concerning stream flow in the Rio Grande basin collected by the Survey and cooperating parties but also records furnished by individuals connected with private interests." Most of the records have been taken from publications of the Geological Survey, but original estimates have been revised where later data have indicated errors.

421. Profile surveys in 1915 along the Rio Grande, Pecos River, and Mora River, New Mexico, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 11 pp., 11 pls. 15c.

Gives results of surveys made to determine the location of undeveloped water power on some of the rivers of the United States that are adapted to the development of power by low or medium heads at 20 to 100 feet.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II, Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xiv, 395 pp., 30 pls. and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams; sediment in the Rio Grande, pp. 55–57.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, pls. 54–57. Describes reservoir sites in Rio Arriba, Taos, Santa Fe, Bernalillo, Mora, San Miguel, Valencia, Socorro, and Sierra counties, New Mexico, and on tributaries of the Rio Grande; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, pls. 58–106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, pls. 147–182. Discusses surveys, flood-water storage, dam site, estimated cost of El Paso reservoir, Texas.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II–Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457-533, pls. 35-39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. II—Papers chiefly of a theoretic nature, v, 653 pp., 105 pls. $1.65. Contains:

*Geology of portions of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Tex., with especial reference to the occurrence of artesian and other underground waters, by R. T. Hill and T. W. Vaughan, pp. 193–322, pls. 21–64. Discusses the general principles of artesian waters, the capacity of the various rock sheets for water, the nonflowing wells, the gravity springs, and artesian wells of the Edwards Plateau and Rio Grande Plain; the probable identity of source of artesian and fissure spring waters, and the availability and limitations of underground waters; treats of the chemical quality of the artesian well waters, and gives analyses of waters from the various beds and of spring waters from Austin and vicinity.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols., and separate case for maps with Pt. V. *Pt. IV, Hydrography, 768 pp., 156 pls. $2.35. Contains:

*The High Plains and their utilization, by W. D. Johnson, pp. 601-741, pls. 113-146. Describes the area lying in an irregular belt about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Pts. III and IV, 1902.) 4 parts. *Pt. IV, Hydrography, 631–669 pp., pls. 51–65. $2.20. Contains:

*Conclusion of The High Plains and their utilization.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the Superintendent of Documents, Washington, D. C. Bulletins are of octavo size.

*264. Records of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated records of wells in Colorado, Louisiana, Mew Mexico, and Texas, and detailed record of well near Houston, Harris County, Tex. This well was selected because it affords definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 209 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Louisiana, New Mexico, and Texas; and detailed records of wells in Eddy and Torrance counties, New Mexico; and Bexar, Cameron, Coleman, Dallas, Dimmit, Duval, Fayette, Fort Bend, Guadalupe, Hardin, Harris, Hays, Jasper, Johnson, Kendall, Lampasas, Liberty, Medina, Navarro, Nueces, Parker, Williamson, and Zavalla counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea levels of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geological folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in higher-priced folios) are ordered at one time a discount of 40 per cent is allowed; $5.10 is the minimum amount accepted at this rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

42. Nueces, Texas. 5c.

Describes geography and geology, and relations of geologic formations to underground waters.

*64. Uvalde, Texas.

Describes the topography and geology of the area, the streams, springs and wells, and discusses the possibility of obtaining artesian flows.

*76. Austin, Texas.

Describes the topography and geology of the area, the drainage, and discusses the possibility of obtaining artesian water.

*120. Silverton, Colorado.

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[1] Index maps showing areas in the western Gulf of Mexico basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey Washington, D. C.

***166. El Paso,[1] Texas.**

Gives analyses of underground waters.

183. Llano-Burnet,[1] Texas. 5c.

Under "Mineral Resources" discusses rainfall, streams, springs, wells, tanks, and cisterns.

194. Van Horn, Texas. 25c.

Gives analyses of water from railroad wells at Van Horn and well at Figure 2 ranch headquarters.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations, have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the western Gulf of Mexico drainage basins are the reports of the State geological surveys of Louisiana and Texas, the reports of the State engineers of Colorado and New Mexico, and the annual reports of the United States Reclamation Service. The following deserve special mention:

Report of commission appointed to revise the laws of the State of Colorado regulating the appropriation, distribution, and use of water. 1890.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the Chief of Engineers, together with a report of Captain Chittenden: 55th Cong., 2d sess., House Doc. 141.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others, made under the direction of the State experiment stations. Louisiana Geol. Survey Bull. 1, 1905.

Preliminary report on the soils and waters of the upper Rio Grande and Pecos valleys in Texas, by H. H. Harrington: Texas Geol. Survey Bull. 2, 1890.

Water supply of southwest Texas, compiled by H. M. Madison. 1912.

Artesian water on the Llano Estacado, by G. G. Shumard: Texas Geol. Survey Bull. 1, 1892.

Preliminary reports on the artesian wells of the Gulf coastal slope, by J. A. Singley, and on the organic remains from the deep well at Galveston, by Gilbert D. Harris: Texas Geol. Survey Fourth Ann. Rept., 1892.

A study of the use of water for irrigation on the Rio Grande del Norte, by W. W. Follett: International (Water) Boundary Comm. Proc., pp. 284–323, 1903.

Silt in the Rio Grande, by W. W. Follett: International Boundary Comm. Proc., 1913.

Silt survey on Pecos River: U. S. Recl. Service Third Ann. Rept., 1905.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

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[1] Issued in two editions (see p. XVI). Specify edition desired.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill, its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls.

*42. The windmill, its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901-2. See also Nos. 64, 94, and 95.

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow, and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey and the reports of the conferences, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States, by M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

Collection of steam-gaging data, by N. C. Grover.

Diamond-drill methods, by G. A. Hammond.

Mean-velocity and area curves, by F. W. Hanna.

Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.

Effect of aquatic vegetation on stream flow, by R. E. Horton.

Sanitary regulations governing construction camps, by M. O. Leighton.

Necessity of draining irrigated land, by Thos. H. Means.

Alkali soils, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.

Equipment of a cable gaging station, by E. C. Murphy.

Silting of reservoirs, by W. M. Reed.

Farm-unit classification, by D. W. Ross.

Cost of power for pumping irrigating water, by H. A. Storrs.

Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.,

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground-water developments, and to indeterminate causes.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists of publications relating to underground waters, and contains the following brief reports of general interest:
Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl. 10c.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1908. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collections of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, and chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

334. The Ohio Valley flood of March-April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States. 1914. N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

*(*e*) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65. Scope indicated by title.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of waters of the geysers in Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada, and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells, shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls.

(*c*) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77-84.

(*e*) A method for correcting river discharge for changing stage, by B. E. Jones, pp. 117-130.

(*f*) Conditions requiring the use of automatic gages in obtaining stream-flow records, by C. H. Pierce, pp. 131-139.

Papers presented at conference of engineers of water-resources branch in December, 1914.

400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer. Contains:

(*a*) The people's interest in water-power resources, by G. O. Smith, pp. 1-8.

(*c*) The measurement of silt-laden streams, by R. C. Pierce, pp. 39-51.

(*d*) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

416. The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis. 1917. 59 pp. 10c.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883-84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125 to 173, pl. 21. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, C. E., pp. 363-561, pls. 107-146. See Water-Supply Paper 87.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, C. E., pp. 101–349, pls. 111–145. Discusses the economical aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W J McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. 3–4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. 6–16. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium, and through sands, sandstones, and silts; discusses results obtained by other investitagors, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller. 1908. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

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[A—Annual Reports; M—Monograph; B—Bulletin; P—Professional Paper; W—Water-Supply Paper G F—Geologic folio.]

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[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

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DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 439

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART IX. COLORADO RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
ROBERT FOLLANSBEE, E. A. PORTER, and C. C. JACOB, District Engineers

Prepared in cooperation with
THE STATES OF ARIZONA, NEVADA, UTAH AND WYOMING

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

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SURFACE WATER SUPPLY OF COLORADO RIVER BASIN, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1917.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000

In the execution of the work many private and State organizations have cooperated, either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 14.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In

connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miners' inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 9).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

"Stage-discharge relation;" an abbreviation for the term "relation of gage height to discharge."

"Control;" a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.03719	1.041	1.079	1.116	1.153
2.........	.07438	2.083	2.157	2.231	2.306
3.........	.11157	3.124	3.236	3.347	3.459
4.........	.14876	4.165	4.314	4.463	4.612
5.........	.18595	5.207	5.393	5.578	5.764
6.........	.22314	6.248	6.471	6.694	6.917
7.........	.26033	7.289	7.550	7.810	8.070
8.........	.29752	8.331	8.628	8.926	9.223
9.........	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	1.983	55.54	57.52	59.50	61.49
2.........	3.967	111.1	115.0	119.0	123.0
3.........	5.950	166.6	172.6	178.5	184.5
4.........	7.934	222.1	230.1	238.0	246.0
5.........	9.917	277.7	287.6	297.5	307.4
6.........	11.90	333.2	345.1	357.0	368.9
7.........	13.88	388.8	402.6	416.5	430.4
8.........	15.87	444.3	460.2	476.0	491.9
9.........	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.0864	2.419	2.506	2.592	2.678
2.........	.1728	4.838	5.012	5.184	5.356
3.........	.2592	7.257	7.518	7.776	8.034
4.........	.3456	9.676	10.02	10.37	10.71
5.........	.4320	12.10	12.53	12.96	13.39
6.........	.5184	14.51	15.04	15.55	16.07
7.........	.6048	16.93	17.54	18.14	18.75
8.........	.6912	19.35	20.05	20.74	21.42
9.........	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.65
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8	9.00	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13,572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet}\times\text{fall in feet}}{11}=$ net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

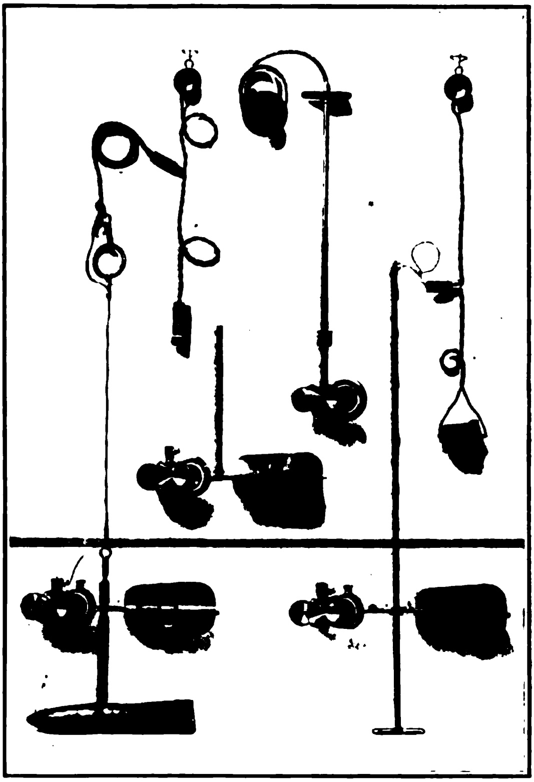
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

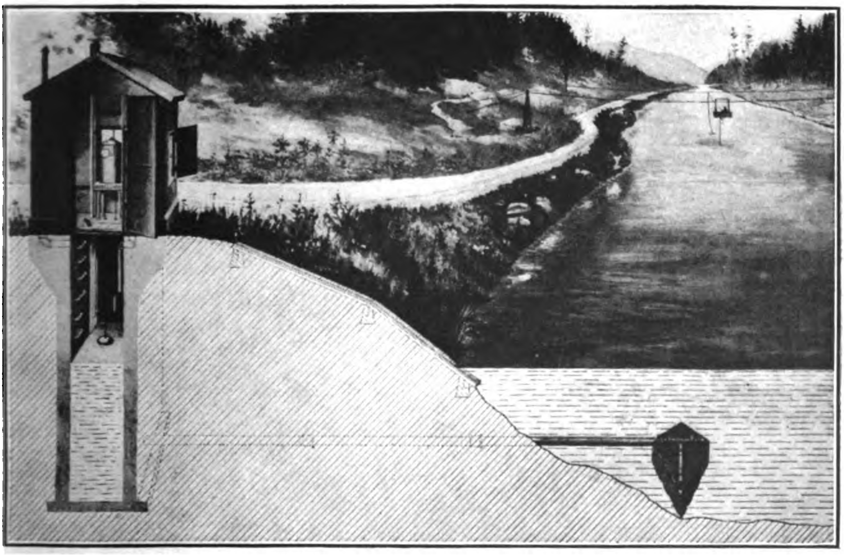
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuations the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

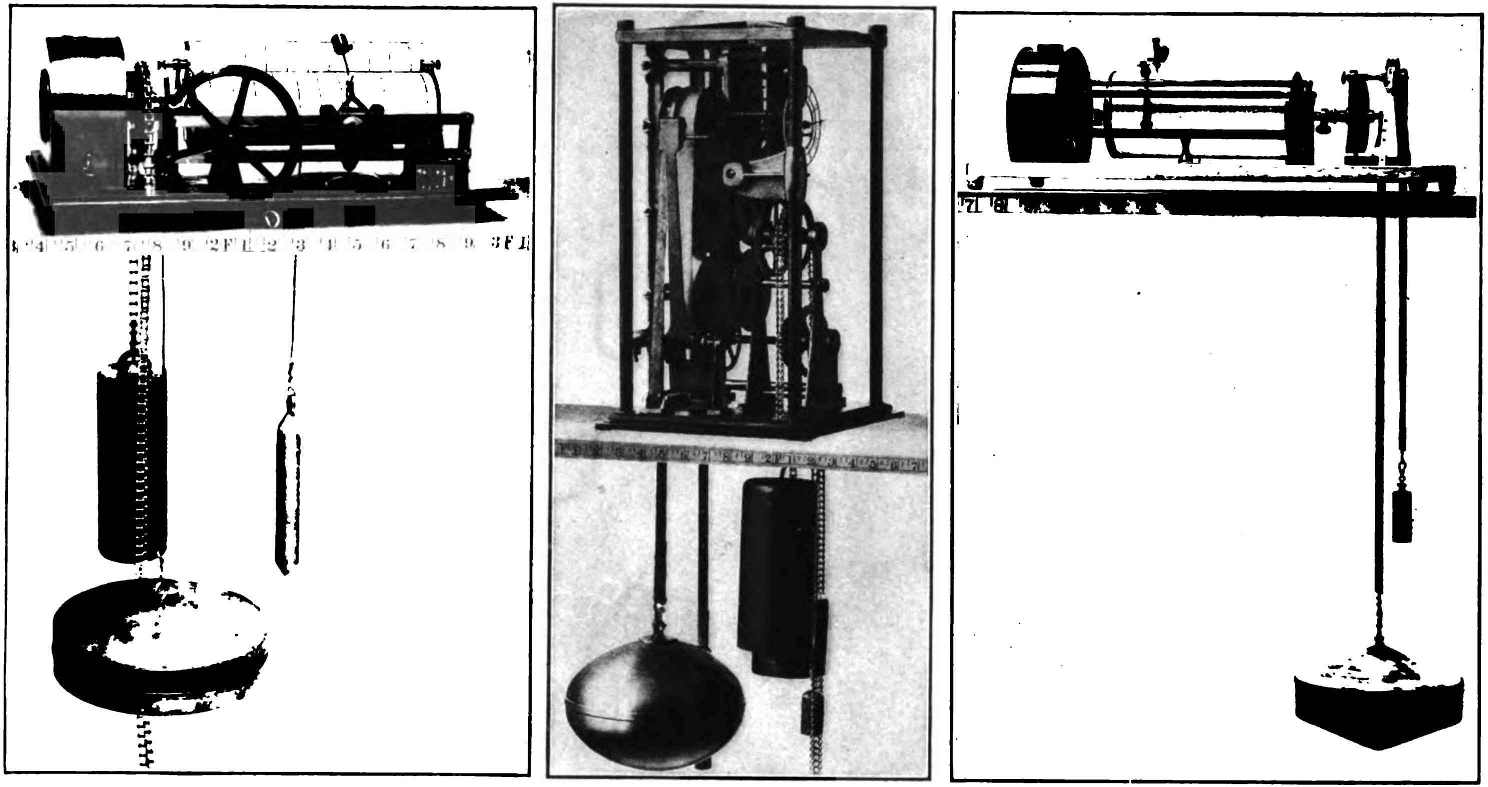
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.

B. GURLEY PRINTING.

C. FRIEZ.

WATER-STAGE RECORDERS.

the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 6, are based.

The deficiency table presented for some of the gaging stations shows the number of days in each year on which the mean daily discharge was less than the discharge given in the table. By subtraction the table gives the number of days each year that the mean daily discharge was between the discharges given in the table and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given. If one discharge rating table was used throughout the period covered by the deficiency table, gage heights that correspond to the discharges are also given. For convenience the theoretical horsepower per foot of fall corresponding to the discharge is given in the table on page 8. In using the table for studies of power, allowance should be made for the various losses, the most important being wheel loss and head loss.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanence of the stage-discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.[1]

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

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[1] For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C. Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53–59, 1916.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

The work in Arizona, Nevada, Utah, and Wyoming was carried on under cooperative agreement between the United States Geological Survey and the States, and special acknowledgments are due to the cooperating State officials, R. H. Forbes, director, and G. E. P. Smith, irrigation engineer, of the Arizona State Agricultural Experiment Station; W. M. Kearney, State engineer of Nevada; W. D. Beers, State engineer of Utah; and J. B. True, State engineer of Wyoming.

The State engineer of Colorado, John E. Field, paid the observers at the stations on North Fork of Grand River near Grand Lake, Grand River near Kremmling, and Williams Fork near Parshall, and cooperated in the maintenance of station on Yampa River near Maybell.

The United States Reclamation Service paid for a part of the maintenance of stations on Green River at Green River, Wyo., Black Fork at Granger, Wyo., Henrys Fork near Linwood, Utah, and Yampa River near Maybell, Colo.

The United States Forest Service furnished gage-height record for stations on Pine Creek at Fremont Lake outlet, and at Pinedale, Wyo.; also furnished the services of an hydrographer for two months, and all or a part of gage-height records for 20 stations in the Grand River basin in Colorado.

The Uinta County Irrigation Co. furnished gage-height record for North Piney Creek near Marbleton, Wyo.

Records of stage for Big Sandy Creek near Farson, Wyo., were furnished by C. E. Howell; for East Fork River at East Fork canal by S. E. Bartlett; for Grand River near Fruita, Colo., by United States Weather Bureau; and for Crystal River at Marble, Colo., by the Colorado-Yule Marble Co.

W. M. Tait furnished valuable assistance in maintaining station on Grand River at Glenwood Springs, Colo.

The Colorado Power Co. furnished the water-stage recorder used on Grand River at Glenwood Springs, Colo.

The Vernal Milling & Light Co. furnished records of stage for Ashley Creek and paid expenses of field engineers.

Acknowledgments are due to the United States Reclamation Service for financial cooperation in collection of records for stations in Utah.

Records of stage for Mill Creek near Moab, Utah, were furnished by Moab Light & Power Co.; for stations in vicinity of Monticello, Utah, by United States Forest Service and water users; for Leeds Creek near Leeds, Utah, by R. C. Savage; and for several of the stations on Muddy River near Moapa by Muddy Valley Irrigation District, who also furnished records of current-meter measurements.

The United States Indian Service cooperated in the maintenance of stations on Gila River at Guthrie, near Solomonville, near San Carlos, at Kelvin, and San Francisco River at Clifton, Ariz.

The United Verde Copper Co. cooperated in maintaining station on Verde River near Clarkedale, Ariz.

The Southwestern Arizona Fruit & Irrigation Co. furnished gage-height record for Gila River near Sentinel, Ariz.

DIVISION OF WORK.

Data for stations in Arizona were collected and prepared for publication under the direction of C. C. Jacob and C. E. Ellsworth, district engineers, who were assisted by J. B. Spiegel, M. D. Anderson, Wallace Adams, and Mrs. Carol H. Shrigley.

Data for stations in Colorado and Wyoming were collected and prepared for publication under the direction of Robert Follansbee, district engineer, who was assisted by R. H. Fletcher, W. R. King, H. W. Fear, P. V. Hodges, H. K. Smith, and Miss Jane Hanna.

For stations in Nevada and Utah data were collected and prepared for publication under the direction of E. A. Porter and C. C. Jacob, district engineers, who were assisted by Lynn Crandall, A. B. Purton, L. W. Jordan, J. J. Sanford, W. E. Dickinson, W. B. Maughan, and Miss Ruby Christensen.

The records were reviewed and assembled by B. J. Peterson, assistant engineer.

GAGING-STATION RECORDS.

GREEN RIVER AND THE MAIN COLORADO.

GREEN RIVER NEAR DANIEL, WYO.

Location.—Near line between Tps. 32 and 33 N., R. 110 W., at highway bridge 6 miles southeast of Daniel, in Fremont County. No large tributary within several miles.

Drainage area.—932 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

Gage.—Chain on downstream side of bridge; read by Mrs. A. P. Sommers.

Discharge measurements.—Made from two-span bridge or by wading.

Channel and control.—Bed composed of coarse gravel and small boulders. Control 100 feet downstream at small rapids; shifted during winter of 1915–16 and again during high water in June, 1916. Banks high; overflow unlikely.

Extremes of discharge.—Maximum stage recorded during year, 5.3 feet at 5.30 p. m. June 20 (discharge, 4,810 second-feet); minimum discharge probably occurred during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 212 second-feet from Green River above station near Daniel.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; changed during winter and again during high water in June. Rating curve used October 1 to December 4 well defined above and extended below 400 second-feet; curves used March 21 to June 20 and June 25 to September 30 fairly well defined above 240 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Green River near Daniel, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	R. H. Fletcher	2.48	397	June 17	R. H. Fletcher	4.63	3,550
Apr. 25	Robert Follansbee	3.30	1,250	Aug. 6	H. K. Smith	3.58	1,360
May 30	R. H. Fletcher	3.43	1,350				

Daily discharge, in second-feet, of Green River near Daniel, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	695	246	246		590	1,850	2,030	1,730	1,280	515
2	640	238	246		460	2,030	1,760	1,890	1,280	515
3	621	226	246		500	2,210	1,670	1,890	1,280	494
4	592	226	246		545	2,390	1,850	1,890	1,280	480
5	465	226			590	2,570	2,030	1,890	1,280	466
6	452	226			420	2,570	2,570	1,810	1,350	445
7	432	246			385	2,390	2,390	1,810	1,420	424
8	400	268			420	2,750	2,210	1,810	1,500	410
9	389	268			460	2,750	2,570	1,730	1,500	410
10	372	246			800	2,390	2,930	1,730	1,420	410
11	356	226			800	2,210	3,110	1,730	1,420	380
12	345	206			860	2,030	3,110	1,730	1,420	380
13	335	246			500	1,910	3,110	1,730	1,350	380
14	305	290			640	1,850	2,930	1,730	1,350	338
15	305	315			920	1,670	3,110	1,730	1,350	320
16	305	290			985	1,340	3,110	1,730	1,280	302
17	295	246			860	1,190	3,480	1,730	1,150	290
18	295	340			800	1,190	4,240	1,730	1,030	290
19	286	290			800	1,190	4,240	1,730	920	280
20	286	246			860	1,260	4,620	1,730	820	265
21	286	246		1,670	920	1,850	4,520	1,730	770	250
22	272	246		1,670	920	1,940	4,050	1,730	720	240
23	259	246		1,500	1,050	1,670	2,840	1,730	720	240
24	250	246		1,580	1,050	1,670	1,850	1,730	720	230
25	250	246		1,420	1,190	1,500	1,730	1,730	675	230
26	250	246		1,340	1,500	1,500	1,810	1,730	630	215
27	250	246		1,340	1,850	1,340	1,810	1,730	590	215
28	250	246		985	2,390	1,260	1,730	1,570	566	200
29	250	246		920	2,390	1,190	1,730	1,420	550	200
30	250	246		745	2,210	1,500	1,730	1,350	480	190
31	250			690		1,850		1,280	515	

Note.—Shifting-control method used June 21–24. Stage-discharge relation affected by ice Dec. 5 to Mar. 20; observation of stage discontinued.

Monthly discharge of Green River near Daniel, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	695	250	354	21,800
November	340	206	252	15,000
December 1–4	246	246	246	1,950
March 21–31	1,670	690	1,260	27,500
April	2,390	885	956	56,900
May	2,750	1,190	1,840	113,000
June	4,620	1,670	2,700	161,000
July	1,890	1,280	1,720	106,000
August	1,500	480	1,050	64,600
September	515	190	333	19,800

GREEN RIVER AT GREEN RIVER, WYO.

Location.—In sec. 22, T. 18 N., R. 107 W., at highway bridge a quarter of a mile south of railroad station at Green River, in Sweetwater County. No tributary within several miles.

Drainage area.—7,670 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—May 2, 1895, to October 31, 1906; March 1, 1915, to September 30, 1916.

Gage.—Chain on upstream side of left span; read by William Hutton, jr. Gage used from 1895 to 1906 was vertical staff attached to submerged cribbing on east bank of river near pump house one-third mile above site of present gage. No determined relation between gages.

Discharge measurements.—Made from two-span bridge.

Channel and control.—Bed composed of compact gravel and small boulders; sand bar on one side; slightly shifting. No well-defined control. Banks high and not subject to overflow at stages less than 10.5 feet.

Extremes of discharge.—Maximum stage recorded during year, 10.0 feet at 8 a. m. June 22 (discharge, 14,100 second-feet); minimum discharge, 295 second-feet January 12.

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 208 second-feet from Green River between this station and the one near Daniel.

Regulation.—None.

Accuracy.—Stage-discharge relation changes between narrow limits at long intervals; affected by ice during winter. Rating curve well defined between 500 and 14,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying gage height to rating table. Records excellent except those for winter period, which range in accuracy from fair to good.

Cooperation.—Gage-height record October 1 to November 30 and March 1 to September 30 furnished by United States Weather Bureau.

Discharge measurements of Green River at Green River, Wyo., during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	12	R. H. Fletcher	4.24	1,270	Apr.	18	Robert Follansbee	5.84	3,040
Jan.	7	R. I. Meeker	[a] 4.52	456	May	15	H. K. Smith	6.69	4,510
	27	.....do	[a] 4.98	452	June	5	R. H. Fletcher	6.35	3,910
Feb.	17	R. H. Fletcher	[a] 5.10	561		20	.....do	9.91	13,800
Mar.	10	.....do	[a] 5.24	697	Aug.	10	H. K. Smith	6.08	3,210

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Green River at Green River, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,620	910	625	320	422	595	1,890	4,000	3,130	9,040	2,970	1,290
2	1,520	910	835	345	478	595	1,890	3,630	3,630	9,040	2,970	1,290
3	1,160	910	690	345	478	595	1,890	3,290	2,530	8,450	2,970	1,200
4	1,160	910	690	395	535	595	2,260	3,290	4,000	7,880	2,970	1,200
5	1,420	910	910	395	535	595	2,130	3,290	4,000	7,880	2,670	1,200
6	1,470	910	835	450	535	658	2,130	4,000	4,820	7,880	2,530	1,030
7	1,470	910	910	450	798	658	1,890	4,600	6,540	7,060	2,530	1,030
8	1,380	910	835	422	798	725	1,670	4,820	6,800	6,540	3,130	1,030
9	1,380	910	910	395	595	1,030	1,670	5,290	6,800	6,540	3,130	950
10	1,290	910	835	370	595	950	1,670	5,290	7,060	6,800	3,290	960
11	1,240	872	835	345	565	950	2,390	5,780	8,160	6,800	3,130	950
12	1,240	798	690	295	565	798	3,810	5,780	9,340	6,280	2,820	950
13	1,240	690	690	345	565	990	3,810	5,290	9,650	6,030	2,530	870
14	1,240	690	565	345	565	910	2,970	4,820	9,650	5,530	1,890	870
15	1,240	690	625	395	565	1,240	2,670	4,390	9,040	5,050	2,130	870
16	1,240	760	625	345	565	1,780	2,670	4,000	9,650	5,290	1,890	870
17	1,160	760	505	345	565	2,070	3,290	3,630	10,600	5,530	1,890	870
18	1,070	760	395	450	565	2,260	2,970	3,290	11,600	5,290	1,890	870
19	1,070	835	505	505	565	4,390	2,970	2,970	12,800	5,290	1,780	795
20	1,070	910	450	565	565	3,290	2,970	2,970	13,500	4,820	1,780	795
21	1,070	910	450	505	565	4,000	2,530	2,970	13,800	4,190	1,670	795
22	990	910	565	505	565	6,280	2,390	3,290	13,800	4,000	1,670	725
23	1,070	835	690	450	565	4,190	2,130	3,290	12,500	3,630	1,670	725
24	1,030	835	625	450	565	3,630	2,260	3,630	10,600	3,460	1,470	725
25	990	798	625	450	565	3,290	2,390	3,630	8,450	3,130	1,380	725
26	990	760	535	450	565	2,390	2,670	3,630	7,060	2,970	1,380	725
27	910	690	450	450	565	2,130	3,290	3,630	7,060	2,820	1,380	660
28	960	625	345	450	565	2,260	3,630	3,290	7,060	2,820	1,380	660
29	910	625	395	450	565	2,390	4,000	2,970	7,880	2,970	1,290	660
30	910	625	370	450	....	2,670	4,390	2,820	8,450	3,130	1,290	660
31	910	....	345	450	....	2,260	....	2,670	....	3,130	1,290	....

NOTE.—Stage-discharge relation affected by ice Nov. 13 to Mar. 16; discharge determined from gage heights, discharge measurements, observer's notes, and weather records. Shifting-control method used Oct. 1-10.

Monthly discharge of Green River at Green River, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,620	910	1,170	71,900
November	910	625	816	48,600
December	910	345	624	38,400
January	565	295	416	25,600
February	798	422	569	32,700
March	6,280	595	1,970	121,000
April	4,390	1,670	2,640	157,000
May	5,780	2,670	3,890	239,000
June	13,800	2,530	8,330	496,000
July	9,040	2,820	5,460	336,000
August	3,290	1,290	2,150	132,000
September	1,290	660	898	53,400
The year	13,800	295	2,410	1,750,000

GREEN RIVER AT LITTLE VALLEY, NEAR GREEN RIVER, UTAH.

Location.—In sec. 4, T. 22 S., R. 16 E., about a mile above old Little Valley ferry and about 6 miles downstream from Green River, Emery County.

Drainage area.—41,000 square miles.

Records available.—December 18, 1910, to September 30, 1916. Records obtained at Green River (known also as Elgin or Blake) from 1894 to 1899, and 1905 to 1911, give practically the same flow.

Gage.—Friez water-stage recorder on left bank about a mile above old ferry cable. Various gages at cable were in use from December 18, 1910, to November 6, 1914, when the Friez recorder was installed. The records at Green River were obtained from chain gage at the Denver & Rio Grande Railroad bridge until December 2, 1910, when the gage was moved 200 feet upstream to the new highway bridge.

Discharge measurements.—Made from a car on the ferry cable.

Channel and control.—Bed composed of gravel and sand. Control probably about two-thirds of a mile below the gage; apparently fairly permanent.

Extremes of discharge.—Maximum stage during the year, from water-stage recorder, 8.48 feet at 10 a. m. May 13 (discharge 30,800 second-feet); minimum stage, below −0.5 foot on December 22, due to an ice jam above Green River (discharge probably less than 300 second-feet).

1894–1898 and 1905–1916: Maximum discharge recorded, 68,800 second-feet May 29, 1897; minimum discharge recorded, less than 300 second-feet December 22, 1915.

Ice.—Stage-discharge relation seriously affected by ice. Mean flow estimated for January and part of February from current-meter measurements, observer's notes, and weather records.

Diversions.—Station is below practically all diversions from Green River.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 1,500 and 30,000 second-feet. Daily discharge ascertained by applying gage height to rating table except for periods indicated in footnote to daily-discharge table. Open water records considered good; winter records fair.

Discharge measurements of Green River at Little Valley, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	L. W. Jordan	1.37	2,880	Feb. 24[b]	A. B. Purton	1.20	2,570
Jan. 4[a]	Lynn Crandall	.76	1,770	May 11	W. E. Dickinson	8.15	28,200
28[a]	....do	.81	1,930	June 26	....do	7.01	23,700

[a] River full of floating slush ice. No great amount of backwater.
[b] Apparently natural conditions. Few cakes of ice floating.

Daily discharge, in secona-feet, of Green River, at Little Valley, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		2,800	2,060			2,720	8,700	21,300	18,500	15,400	6,720	2,970
2	8,000	2,720	1,780			2,630	8,880	22,800	19,900	14,900	6,280	2,970
3		2,630	1,650			2,630	9,250	22,300	20,400	14,900	6,420	2,970
4		2,630	1,620	1,760		2,800	8,880	19,400	20,400	14,900	6,280	2,970
5		2,540	1,870			2,880	8,170	18,000	20,800	14,900	6,720	2,800
6		2,540	2,050			3,240	7,660	17,600	21,300	14,500	8,170	2,800
7	3,910	3,910	2,240			2,880	7,660	17,100	22,800	14,100	7,500	2,720
8	3,810	3,710	2,300			2,880	7,660	17,600	23,300	13,200	7,500	2,800
9	3,710	3,150	2,380			3,060	7,830	20,800	22,800	12,800	8,520	2,630
10	3,620	3,240	2,460			3,520	7,830	24,800	22,800	12,400	7,500	2,800
11	3,520	3,240	2,460			3,910	7,500	28,200	23,800	11,600	7,180	2,540
12	3,520	3,150	2,460			4,220	7,500	30,300	24,300	10,800	7,180	2,630
13	3,420	3,330	2,380			4,530	7,340	30,300	24,300	10,400	7,340	2,800
14	3,420		2,460			6,040	7,500	30,300	25,200	10,000	6,720	2,720
15	3,330					10,400	8,170	28,200	26,200	10,000	6,870	2,630
16	3,240					15,100	10,000	26,200	26,200	10,000	7,180	2,540
17	3,240				2,380	16,000	12,400	24,300	26,200	9,250	6,720	2,800
18	3,240				2,380	14,900	12,400	22,300	25,200	8,880	5,730	2,800
19	3,240		1,550		2,380	14,500	12,400	19,400	24,800	8,520	5,340	2,630
20	3,240	2,380	450		2,380	14,100	12,400	17,600	24,300	8,170	5,220	2,460
21	3,240	2,380	800		2,380	13,200	12,800	16,700	25,200	7,830	4,750	2,380
22	3,240	2,380	250		2,630	13,200	13,200	15,800	26,200	8,000	4,420	2,300
23	3,150	2,380	1,690		2,540	15,400	13,200	15,800	26,200	7,660	4,110	2,270
24	3,150	2,460	1,620		2,540	17,100	12,400	16,700	26,200	7,840	4,010	2,250
25	3,060	2,630	1,550		2,540	17,600	11,600	19,400	25,200	6,870	3,810	2,300
26	3,060	2,880			2,540	16,700	11,600	18,500	23,800	6,570	3,620	2,300
27	2,970	2,970			2,630	13,700	12,400	17,600	21,300	6,420	3,420	2,190
28	2,970	2,800		1,960	2,720	12,000	14,100	17,600	19,400	6,420	3,330	2,100
29	2,880	2,630	1,410		2,720	10,800	15,800	17,600	17,100	8,340	3,240	2,060
30	2,800	2,380	1,480			9,820	18,500	17,600	15,800	8,340	3,240	1,990
31	2,800		1,550			8,880		17,600		7,180	3,150	

NOTE.—Discharge estimated, on account of ice, from meter measurements, observer's notes, and weather records as follows: Dec. 15–18, 2,060 second-feet; Dec. 19–24, 30–31, as in table; Dec. 26–28, 1,480 second-feet; Jan. 1–3 (interpolated), 1,690 second-feet; Jan. 5–12, 1,720 second-feet; Jan. 13–27, 1,690 second-feet; Jan. 29–31, 1,760 second-feet; Feb. 1–5, 1,720 second-feet; Feb. 6–16, 2,140 second-feet. Discharge interpolated on account of break in gage-height record Oct. 1, 8,440 second-feet, 3–6, 5,960 second-feet; Nov. 14–19, 2,860 second-feet.

Monthly discharge of Green River at Little Valley, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8,440	2,800	3,940	242,000
November	3,910	2,380	2,830	168,000
December	....	....	1,770	109,000
January	....	....	1,720	106,000
February	2,720	....	2,240	129,000
March	17,600	2,630	9,080	558,000
April	18,500	7,340	10,500	625,000
May	30,300	15,800	21,000	1,290,000
June	26,200	15,800	23,000	1,370,000
July	15,400	6,420	10,300	633,000
August	8,520	3,150	5,750	354,000
September	2,970	1,990	2,570	153,000
The year	30,300	....	7,900	5,740,000

COLORADO RIVER AT YUMA, ARIZ.

Location.—In sec. 35, T. 16 S., R. 22 E., at Southern Pacific Co.'s railroad bridge at Yuma, Yuma County, about 1½ miles below mouth of Gila River.

Drainage area.—242,000 square miles (measured on map compiled from best available maps of Colorado River basin; supersedes previous determinations).

Records available.—April 1, 1878, to September 30, 1916.

Gage.—Vertical staff in two sections at the bridge. Zero of the gage, 102.79 feet above sea level.

Discharge measurements.—Made from cable 600 feet below gage.

Channel and control.—Shifting sand.

Extremes of discharge.—1902–1916: Maximum mean daily discharge, 240,000 second-feet, January 22, 1916;[1] minimum mean daily discharge, 2,600 second-feet January 20, 1913 (stage, 13.95 feet).

Diversions.—Water is diverted for irrigation and power development from main river and tributaries above station.

Regulation.—None.

Accuracy.—Frequent discharge measurements necessitated by shifting of channel and control. Daily discharge computed by shifting-control method. Records considered good for a station of this type.

Cooperation.—Record of daily discharge is published as furnished by United States Reclamation Service, through L. M. Lawson, project manager.

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[1] For further particulars regarding this flood see article on Colorado River flood at Yuma: Eng. News, vol. 75, p. 246, 1916.

Discharge measurements of Colorado River at Yuma, Ariz., during the year ending Sept. 30, 1916.

[Made by U. S. Reclamation Service.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 1	15.40	4,040	Jan. 31	30.40	161,800	June 2	20.55	44,000
4	16.85	9,050	Feb. 2	21.8	67,600	5	20.80	46,600
6	16.50	9,120	4	20.1	44,590	7	21.25	49,900
8	16.60	7,890	7	17.3	23,950	9	21.80	54,200
11	16.70	8,362	9	16.8	19,900	12	22.00	56,900
13	16.50	9,050	11	16.65	19,430	14	22.50	59,900
15	16.30	8,700	14	17.10	18,520	16	22.40	57,700
18	16.00	6,670	16	17.8	22,990	19	22.90	63,700
20	15.90	6,300	18	18.0	22,990	21	23.25	66,700
22	16.00	5,970	21	18.3	22,690	23	23.80	70,200
25	16.00	6,460	23	18.4	20,350	26	23.65	71,400
27	15.95	6,900	25	19.1	25,760	28	23.55	72,000
29	16.00	6,410	28	18.5	22,800	30	23.10	68,300
Nov. 1	16.20	6,290	Mar. 1	18.60	20,710	July 3	22.05	63,000
3	16.25	6,540	4	19.25	23,830	5	20.75	53,900
5	15.85	4,980	6	19.20	22,650	7	20.20	46,200
8	16.00	5,680	8	18.85	22,400	10	19.75	39,900
10	16.25	4,530	10	18.90	22,580	12	19.50	37,600
12	16.35	5,760	13	18.55	21,900	14	19.25	34,400
15	16.25	5,670	15	19.75	28,000	17	19.30	34,200
17	16.35	6,190	16	19.60	26.790	19	19.15	32,300
19	16.90	7,910	17	19.90	26,540	21	18.50	28,700
22	16.45	6,290	20	20.00	28,580	24	17.90	25,200
24	16.30	6,360	22	20.65	34,090	26	17.60	24,100
26	16.10	6,510	24	22.50	50,110	28	17.30	21,300
29	15.80	5,000	26	24.60	67,380	31	18.05	24,400
Dec. 1	15.90	4,910	29	23.60	68,760	Aug. 2	18.60	27,400
3	16.00	5,160	31	23.05	65,550	4	18.00	22,500
6	16.05	5,800	Apr. 3	20.2	40,100	7	19.20	31,200
8	16.20	5,810	5	19.65	39,200	9	20.05	36,800
10	16.40	6,870	7	19.20	35,500	11	19.85	36,300
13	15.90	4,860	10	18.90	31,100	14	19.55	33,400
15	15.80	4,870	12	19.20	32,400	16	18.90	27.700
17	16.00	5,150	14	18.90	29,400	18	18.60	26,400
20	16.40	6,660	17	18.40	27,200	21	19.75	32,500
22	16.60	6,270	19	19.30	30,800	23	19.35	27,300
24	16.50	6,640	21	19.80	33,000	25	18.70	23,100
27	16.25	5,650	24	20.05	36,000	28	17.55	17,000
29	16.20	5,490	26	20.07	39,300	30	17.10	15,100
31	16.00	4,760	28	20.45	38,300	Sept. 1	17.00	13,600
Jan. 3	17.00	8,640	May 1	20.90	40,800	4	16.90	12,300
5	16.00	5,850	3	21.30	43,300	6	16.90	11,700
7	16.10	5,250	5	21.55	46,600	8	16.50	11,900
10	16.10	4,170	8	22.20	50,400	11	16.45	10,000
12	16.20	3,850	10	22.30	53,900	12	20.45	29,100
14	16.50	5,210	12	21.75	49,600	13	18.20	16,300
17	16.70	7,130	15	21.80	53,600	15	17.15	11,400
19	18.20	14,030	17	22.50	55,400	18	17.55	14,300
20	22.85	51,885	20	23.50	61,900	20	17.50	14,100
21	28.75	109,100	22	24.50	69,900	22	17.00	11,700
24	22.90	84,020	24	25.00	74,800	25	16.80	9,500
26	20.65	52,920	26	23.20	69,800	27	16.80	8,800
28	18.70	36,060	29	20.65	49,000	29	16.90	8,300
30	30.00	145,690	31	20.30	44,700			

Daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,200	6,300	4,900	5,000	113,000	20,000	59,000	40,300	44,300	65,600	26,500	13,600
2	3,500	6,400	5,200	5,000	67,500	25,200	44,700	41,000	44,500	64,500	27,400	12,500
3	4,100	6,500	5,200	7,500	44,800	22,500	40,000	43,300	44,500	62,700	23,300	14,000
4	9,300	6,300	6,200	5,300	41,000	23,500	39,600	47,000	47,200	57,700	22,500	12,300
5	9,300	5,000	5,300	5,900	34,500	24,500	39,200	47,200	47,000	53,600	22,500	12,000
6	9,100	5,500	5,800	5,300	30,800	22,600	38,800	49,200	46,500	49,500	29,200	11,700
7	7,700	5,300	5,800	5,500	23,900	23,000	35,500	50,200	49,900	47,000	31,800	11,500
8	8,700	6,000	5,800	6,000	21,000	22,400	35,000	50,400	53,200	44,800	34,700	11,900
9	10,200	5,700	6,500	4,200	18,800	23,200	32,500	52,600	54,200	41,000	36,500	11,600
10	9,400	4,800	6,900	4,200	18,300	22,600	31,100	53,500	56,000	39,900	37,300	11,800
11	9,000	5,500	6,800	4,100	19,400	20,200	32,400	52,300	56,800	38,700	36,000	10,800
12	8,200	5,800	4,900	3,800	18,300	20,700	32,400	49,000	57,200	37,600	36,300	27,000
13	9,000	5,900	4,900	3,800	19,300	23,000	32,100	51,300	58,800	36,000	36,500	16,300
14	8,800	5,500	4,900	5,200	19,700	27,500	29,400	54,000	59,200	34,400	33,400	13,300
15	8,700	5,700	4,900	5,500	22,000	28,500	29,400	53,600	58,000	34,000	30,800	11,400
16	7,800	5,700	5,000	7,800	23,500	26,500	27,500	55,000	57,000	34,200	27,400	12,200
17	6,500	6,200	5,200	7,100	24,000	27,700	27,500	55,400	59,200	34,200	26,800	15,000
18	6,700	7,900	7,000	7,300	23,000	29,300	29,000	57,700	61,700	33,500	26,100	14,300
19	6,700	7,800	6,800	15,200	20,500	28,800	30,800	59,000	63,700	32,100	27,700	14,100
20	6,300	6,300	6,700	46,800	21,500	29,000	33,700	62,700	65,200	31,800	32,200	14,100
21	6,300	5,600	6,500	101,000	22,700	30,400	33,100	66,500	66,700	28,500	32,700	13,500
22	6,000	6,300	6,300	240,000	20,300	34,500	34,000	70,500	69,000	27,500	31,300	11,700
23	5,600	6,500	6,500	202,000	20,300	42,500	33,700	74,300	70,000	26,100	27,100	11,500
24	5,700	6,400	6,600	97,200	22,000	50,100	36,700	74,800	72,200	25,200	24,400	10,500
25	6,500	7,700	6,500	79,500	25,000	60,400	37,700	72,200	71,700	24,600	22,700	9,500
26	6,700	6,500	4,800	51,500	22,600	68,000	39,300	67,500	71,400	23,900	21,600	9,100
27	6,900	6,300	5,600	43,500	22,500	65,500	40,200	54,800	70,000	21,800	17,900	8,800
28	7,000	4,000	5,500	37,100	22,800	65,700	38,300	49,300	71,200	21,300	16,600	8,500
29	6,400	5,000	5,500	72,000	21,200	68,400	37,000	47,500	70,200	20,400	15,400	8,300
30	6,300	5,000	5,000	158,000	....	68,200	38,800	48,600	67,700	22,100	14,800	8,300
31	6,300	....	5,000	177,000	....	65,500	....	44,700	....	24,400	15,000	....

NOTE.—Discharge records, Jan. 22 to Feb. 2 include estimates of discharge through breaks in levee above Yuma. See "Extremes of discharge" in station description.

Monthly discharge of Colorado River at Yuma, Ariz., for the year ending Sept. 30, 1916.

[Drainage area, 242,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October	10,200	3,500	7,190	0.030	0.03	442,000
November	7,900	4,000	5,980	.025	.03	356,000
December	7,000	4,800	5,760	.024	.03	354,000
January	240,000	3,800	45,800	.189	.22	2,820,000
February	113,000	18,300	28,400	.117	.13	1,630,000
March	68,400	20,000	35,800	.148	.17	2,200,000
April	59,000	27,500	35,600	.147	.16	2,120,000
May	74,800	40,300	54,700	.226	.26	3,360,000
June	72,200	44,300	59,500	.246	.27	3,540,000
July	65,600	20,400	36,700	.152	.18	2,260,000
August	37,300	14,800	27,200	.112	.13	1,670,000
September	27,000	8,300	12,400	.051	.06	738,000
The year	240,000	3,500	29,600	.122	1.67	21,500,000

NOTE.—Monthly and yearly discharge computed by engineers of the United States Geological Survey.

HORSE CREEK BASIN.

HORSE CREEK AT DANIEL, WYO.

Location.—About sec. 2, T. 33 N., R. 111 W., at highway bridge three-fourths mile south of Daniel, Lincoln County. No tributary between station and mouth.

Drainage area.—193 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—April 1, 1915, to September 30, 1916. State engineer maintained station at this point during 1913 and 1914.

Gage.—Vertical staff on upstream side of left abutment; read by Richard Chenette.

Discharge measurements.—Made from single-span bridge or by wading nearby.

Channel and control.—Bed composed of gravel. Control 100 feet below gage at small rapids which shift at intervals.

Extremes of discharge.—Maximum stage recorded during year, 4.8 feet at 8 a. m. June 18 (discharge, 1,120 second-feet); minimum stage, 1.2 feet for part of August and September (discharge, 11 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 161 second-feet from Horse Creek, all above station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent after ice went out. Rating curve fairly well defined between 11 and 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for high and fair for low stages.

Discharge measurements of Horse Creek at Daniel, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	R. H. Fletcher	1.13	17.1	June 16	R. H. Fletcher	4.32	920
Apr. 25	Robert Follansbee	2.50	257	Aug. 6	H. K. Smith	1.82	101
May 30	R. H. Fletcher	2.42	256				

Daily discharge, in second-feet, of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		237	280	382	78	11	16		251	840	120	36	11
2		251	294	340	75	11	17		224	880	98	36	11
3		251	324	340	54	11	18		224	1,080	110	36	11
4		251	324	408	55	11	19		294	880	87	36	11
5		442	309	390	75	11	20		373	920	108	36	11
6		442	460	356	64	11	21		356	840	110	36	11
7		530	600	309	82	11	22		356	640	98	35	11
8		460	530	324	84	11	23		340	720	82	36	11
9		530	720	373	82	11	24		340	340	78	38	11
10		495	880	294	49	11	25	265	340	373	60	35	11
11		460	960	280	42	11	26	265	265	237	50	38	11
12		408	720	120	35	11	27	530	294	390	75	30	11
13		408	800	116	36	11	28	720	294	425	45	22	11
14		408	760	106	36	11	29	530	309	373	77	22	11
15		280	880	100	36	11	30	237	340	425	75	11	11
							31		237		78	11	

Note.—No record Sept. 1, 1915, to Apr. 25, 1916; observer not available.

Monthly discharge of Horse Creek at Daniel, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25-30	720	237	424	5,050
May	530	224	345	21,200
June	1,080	237	607	36,100
July	408	45	180	11,100
August	84	11	44.4	2,730
September	11	11	11.0	655
The period				76,800

COTTONWOOD CREEK BASIN.

COTTONWOOD CREEK NEAR BIG PINEY, WYO.

Location.—In about sec. 21, T. 32 N., R 111 W., at highway bridge near Hayden's ranch, 16 miles north of Big Piney, Lincoln County.

Drainage area.—241 square miles (measured on base map of Wyoming, compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—April 25 to September 30, 1916.

Gage.—Creek flows in two channels a mile apart; vertical staff at highway bridge on each channel; read by Mrs. J. G. Hayden.

Discharge measurements.—Made from bridge on each channel or by wading.

Channel and control.—Bed of north channel composed of coarse gravel; control practically permanent. Bed of south channel composed of sand and gravel; control badly shifting.

Extremes of discharge.—North channel: Maximum stage recorded during period of record, 2.7 feet at 9.30 a. m. April 26 (discharge, 310 second-feet); minimum stage, 1.3 feet September 8-15 and 26-30 (discharge, 30 second-feet).

South channel: Maximum stage recorded, 4.10 feet June 20 (discharge, 166 second-feet); minimum stage recorded, 2.1 feet September 27-30 (discharge, about 3 second-feet).

Ice.—No information.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions from Cottonwood Creek of 38 second-feet above station and 55 second-feet below station.

Regulation.—None.

Accuracy.—North channel: Stage-discharge relation practically permanent. Rating curve fairly well defined between 44 and 300 second-feet. Gage read to half-tenths once daily. Discharge ascertained by applying daily gage height to rating table. Records good.

South channel: Stage-discharge relation not permanent. Rating curve used before June 5 fairly well defined between 25 and 200 second-feet; that used after June 24 poorly defined. Gage read to half-tenths once daily. Discharge ascertained by applying daily gage height to rating table; shifting-control method used June 6 to 23. Records fair.

Discharge measurements of Cottonwood Creek (north channel) near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	Robert Follansbee	2.62	274	May 31	R. H. Fletcher	1.69	66
May 6	H. L. Thackwell	2.20	214	June 17	do	2.21	144
30	R. H. Fletcher	1.66	60	Aug. 6	H. K. Smith	2.12	128

Daily discharge, in second-feet, of Cottonwood Creek (north channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	33	63	125	58	36	16	......	48	145	170	58	40
2	......	40	63	105	69	33	17	......	75	170	124	44	40
3	......	69	53	105	63	33	18	......	63	198	89	44	40
4	......	105	58	89	53	33	19	......	44	248	75	44	40
5	......	170	63	89	53	33	20	......	58	230	58	44	40
6	......	184	75	82	124	33	21	......	63	198	58	58	36
7	......	165	82	75	105	33	22	......	48	145	44	44	36
8	......	97	82	89	75	30	23	......	36	124	44	44	33
9	......	86	89	134	63	30	24	......	36	105	36	44	33
10	......	97	97	105	63	30	25	288	53	97	40	44	33
11	......	75	105	89	53	30	26	230	44	97	44	44	30
12	......	69	105	75	53	30	27	230	36	89	44	44	30
13	......	63	124	63	53	30	28	192	44	105	63	44	30
14	......	48	89	63	53	30	29	150	48	134	63	40	30
15	......	53	105	75	53	30	30	89	53	145	53	40	30
							31	......	58	......	53	36	......

Monthly discharge of Cottonwood Creek (north channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25-30	288	89	196	2,330
May	184	33	69.7	4,290
June	248	53	116	6,900
July	170	36	77.8	4,780
August	124	36	54.7	3,360
September	40	30	33.2	1,980
The period	288	30	75.0	23,600

Discharge measurements of Cottonwood Creek (south channel) near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	Robert Follansbee	3.80	168	May 31	R. H. Fletcher	2.68	43.4
May 6	H. L. Thackwell	3.43	121	June 17	do	3.61	123
30	R. H. Fletcher	2.66	39.9	Aug. 6	H. K. Smith	3.28	54

Daily discharge, in second-feet, of Cottonwood Creek (south channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	22	42	46	9	5.0	16	......	47	112	67	9	4.5
2	......	13	42	37	9	5.0	17	......	47	130	46	8	4.5
3	......	62	47	28	8	5.0	18	......	37	142	28	8	4.5
4	......	78	47	37	7	5.0	19	......	22	166	10	10	4.5
5	......	130	52	37	7	5.0	20	......	68	166	7.0	10	4.5
6	......	118	52	46	46	5.0	21	......	68	148	7.0	10	4.0
7	......	73	57	46	56	5.0	22	......	57	118	6.0	8	4.0
8	......	84	68	46	37	5.0	23	......	57	78	5.0	8	3.5
9	......	62	78	67	20	5.0	24	......	52	67	5.0	7	3.5
10	......	84	84	56	14	4.5	25	166	52	51	5.5	7	3.5
11	......	62	100	46	10	4.5	26	106	47	51	6.0	6	3.5
12	......	62	100	37	9	4.5	27	118	47	56	6.0	6	3.0
13	......	62	95	28	9	4.5	28	106	42	62	8.0	6	3.0
14	......	57.	95	20	10	4.5	29	112	42	67	8.0	6	3.0
15	......	52	100	20	9	4.5	30	84	52	56	7.0	6	3.0
							31	......	47	......	7.0	5	......

Monthly discharge of Cottonwood Creek (south channel) near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 25-30	166	84	115	1,370
May	130	13	58.2	3,580
June	166	42	84.3	5,020
July	67	5	26.6	1,640
August	56	5	12.3	756
September	5.0	3.0	4.28	255
The period	166	3.0	40.0	12,600

EAST FORK BASIN.

EAST FORK AT EAST FORK CANAL, WYO.

Location.—In sec. 10, T. 31 N., R. 106 W., 300 feet above intake of East Fork canal, 18 miles southeast of Boulder, in Fremont County.

Drainage area.—106 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—May 14 to September 30, 1916.

Gage.—Vertical staff on left bank; read by Thomas Cullen.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of small boulders. Control 100 feet downstream from gage; apparently permanent.

Extremes of stage.—Maximum stage recorded during year, 4.4 feet at 8.30 a. m. June 16; minimum stage 1.1 feet for several days in September.

Ice.—No information.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 37 feet from East Fork above station.

Regulation.—None. Many small lakes on headwaters.

Data inadequate for determination of daily discharge.

Discharge measurements of East Fork at East Fork canal, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 29	R. H. Fletcher	2.40	228
Aug. 4	H. K. Smith	1.53	59

Daily gage height, in feet, of East Fork at East Fork canal, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	......	2.9	3.1	1.8	1.1	16	2.07	4.4	2.3	1.4	1.1
2	......	2.8	3.1	1.7	1.1	17	2.22	4.2	2.2	1.3	1.1
3	......	2.7	3.0	1.6	1.1	18	2.02	4.2	2.1	1.3	1.1
4	......	2.8	2.9	1.6	1.1	19	2.22	4.3	2.0	1.2	1.1
5	......	3.8	2.8	1.5	1.1	20	......	3.9	2.0	1.2	1.2
6	......	3.6	2.9	1.6	1.1	21	2.42	3.7	1.9	1.1	1.1
7	......	3.2	2.9	1.5	1.1	22	2.22	3.4	1.9	1.1	1.1
8	......	3.4	2.8	1.6	1.1	23	2.42	3.1	1.8	1.2	1.0
9	......	3.6	2.8	1.6	1.1	24	2.32	2.8	1.9	1.1	1.1
10	......	3.7	2.7	1.5	1.1	25	2.22	2.9	1.9	1.1	1.1
11	......	4.1	2.6	1.5	1.2	26	2.12	3.1	1.9	1.1	1.2
12	......	3.8	2.5	1.5	1.1	27	2.22	3.2	1.8	1.1	1.1
13	......	3.3	2.4	1.4	1.1	28	2.12	3.6	1.8	1.1	1.1
14	2.5	3.5	2.3	1.5	1.1	29	2.32	3.4	1.9	1.1	1.2
15	2.37	3.8	2.4	1.5	1.1	30	2.5	3.1	1.9	1.1	1.2
						31	2.7	......	1.8	1.1	.....

EAST FORK AT NEW FORK, WYO.

Location.—About sec. 33, T. 32 N., R. 108 W., at highway bridge a quarter of a mile south of Newfork, in Fremont County. No tributary between station and mouth, 1 mile below.

Drainage area.—348 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—April 1, 1905, to October 31, 1906; May 11, 1915, to September 30, 1916.

Gage.—Vertical staff on downstream side of left abutment; read by John Tarkelson. Gage used during 1905 was a quarter of a mile farther upstream; that used during 1906 was at bridge but was referred to datum 0.27 foot higher than present gage.

Discharge measurements.—Made from two-span highway bridge or by wading.

Channel and control.—Bed composed of sand and gravel. Control 100 feet below gage at gravel bar which was permanent during 1916. Banks subject to overflow at stage of 6 feet.

Extremes of discharge.—Maximum stage recorded during year, 5.78 feet at 6.30 a. m. June 17 (discharge, 2,180 second-feet); minimum, discharge probably occurs during winter period.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 82 second-feet from East Fork between New Fork and station at East Fork canal.

Regulation.—None. Many small lakes at headwaters.

Accuracy.—Stage-discharge relation practically permanent except for temporary change during high water in May and June; affected by ice during winter. Rating curve well defined between 60 and 560 second-feet, above which it is based on one current-meter measurement at 2,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table; shifting-control method used May 7 to June 18. Records excellent except those for high stages, which are good.

Discharge measurements of East Fork at Newfork, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharg.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	1.66	108	May 29	R. H. Fletcher	2.41	278
Jan. 10	R. I. Meeker	[a] 2.10	61	June 16	.....do	5.48	1,980
Apr. 26	Robert Follansbee	1.91	170	Aug. 5	H. K. Smith	1.53	80

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	125	78	....	262	660	655	104	64
2	129	78	....	231	660	605	102	62
3	140	76	....	216	640	605	91	59
4	148	76	....	216	931	515	82	59
5	140	75	....	314	1,460	430	82	59
6	119	78	....	390	1,640	410	87	59
7	109	75	....	578	1,290	370	91	58
8	106	76	....	650	1,350	351	96	56
9	104	78	246	745	1,720	410	89	56
10	106	78	279	799	2,030	370	85	59
11	109	75	370	794	2,040	314	83	56
12	104	72	216	740	1,850	262	78	56
13	104	75	162	685	1,550	231	78	54
14	100	....	175	610	1,550	188	75	54
15	98	....	216	450	1,800	216	75	53
16	96	....	175	351	1,980	279	75	53
17	96	....	145	293	2,120	262	72	53
18	94	....	162	276	2,050	216	73	53
19	92	....	140	256	2,000	175	64	52
20	91	....	116	290	1,620	150	70	50
21	85	....	96	340	1,200	131	62	50
22	85	....	108	418	920	118	64	50
23	80	....	104	394	655	102	62	50
24	83	....	112	434	582	100	60	50
25	78	....	140	332	705	102	62	50
26	78	....	175	246	810	125	60	50
27	76	....	216	228	920	123	65	50
28	73	....	279	276	1,030	120	59	48
29	73	....	262	228	1,030	129	59	50
30	75	....	262	279	810	123	60	50
31	78	....	....	450	....	114	60	....

NOTE.—Gage not read Nov. 28 to Apr. 8. Discharge Nov. 14-27 not computed owing to backwater from ice.

Monthly discharge of East Fork at Newfork, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	148	73	99.2	6,100
November 1-13	78	72	76.2	1,960
April 9-30	370	96	189	8,240
May	799	216	412	25,300
June	2,120	582	1,330	79,100
July	655	100	268	16,500
August	104	59	75.0	4,610
September	64	48	54.1	3,220

NEW FORK NEAR BOULDER, WYO.

LOCATION.—About sec. 8, T. 32 N., R. 108 W., at highway bridge a mile west of Boulder, in Fremont County. Nearest tributary, Boulder Creek, enters one-eighth mile below.

DRAINAGE AREA.—578 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 11, 1915, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left abutment.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading near by.

CHANNEL AND CONTROL.—Bed composed of sand and gravel underlain by slate; shifts somewhat. No well-defined control. At high water there are two overflow channels, one around right end of bridge and the other from New Fork to Boulder Creek.

Extremes of discharge.—Maximum stage recorded during year, 6.3 feet at 6 a. m. June 22 (discharge, 3,200 second-feet); minimum discharge, 42 second-feet, December 15–17, when stage-discharge relation was affected by ice.

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 199 second-feet from New Fork above station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; control shifts between fairly well defined limits; affected by ice during winter months. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table except for periods indicated in footnote to discharge table. Open-water records good; winter records fair.

Discharge measurements of New Fork near Boulder, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	2.41	378	May 29	R. H. Fletcher	2.43	419
Jan. 10	R. I. Meeker	[a] 2.83	112	June 16	do	5.06	2,140
Feb. 21	R. H. Fletcher	[a] 3.40	151	Aug. 4	H. K. Smith	3.14	708
Apr. 27	Robert Follansbee	2.72	459				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	385	189	105	94	82	105	189	430	475	2,520	770	299
2	385	177	82	130	144	130	223	452	525	2,440	740	260
3	385	174	105	158	189	144	206	430	550	2,440	680	260
4	385	174	105	174	223	158	206	430	575	2,360	740	242
5	385	167	105	174	223	174	223	452	710	2,270	680	223
6	385	167	105	158	242	189	183	525	865	2,180	865	213
7	385	186	82	144	260	144	91	575	930	2,100	740	209
8	363	180	82	130	260	174	180	652	1,000	2,100	865	199
9	341	180	82	118	260	189	242	740	1,100	2,020	770	192
10	341	180	61	118	260	223	320	800	1,480	1,930	740	196
11	341	174	61	118	260	223	550	832	1,560	1,930	710	186
12	320	180	61	105	242	206	550	800	1,800	1,930	680	177
13	320	186	61	118	223	174	452	770	1,800	1,760	652	170
14	299	186	42	130	189	174	500	740	1,890	1,760	625	164
15	299	177	42	158	174	158	625	710	1,970	1,680	575	161
16	280	174	42	144	158	174	550	625	2,270	1,600	550	158
17	280	167	42	130	144	174	430	600	2,610	1,600	500	152
18	280	167	61	94	144	174	550	550	2,860	1,440	452	152
19	260	158	82	130	144	189	408	550	3,120	1,360	452	152
20	260	158	82	158	144	189	320	500	3,120	1,220	475	150
21	242	158	105	158	144	189	825	475	3,120	1,140	475	144
22	242	158	118	118	158	189	832	475	3,200	1,070	430	141
23	223	150	118	144	158	189	363	452	2,780	1,600	385	141
24	223	144	105	174	174	189	341	475	2,440	930	363	136
25	260	144	82	206	174	189	408	525	2,100	800	341	130
26	260	144	82	206	174	189	408	500	1,930	832	341	130
27	206	144	82	189	174	189	408	500	1,980	800	320	125
28	189	150	82	158	158	189	475	475	2,100	800	320	125
29	189	150	72	130	130	189	430	452	2,440	800	299	120
30	189	144	61	72	......	206	430	452	2,520	800	299	120
31	189	......	61	61	......	206	......	475	......	800	299	......

Note.—Stage-discharge relation affected by ice Dec. 1–Mar. 30; discharge estimated from gage heights, discharge measurements, observer's notes, and weather records. Shifting-control method used Oct. 1 to Nov. 30, and Mar. 31 to June 15.

Monthly discharge of New Fork near Boulder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	385	189	293	18,000
November	189	144	166	9,880
December	118	42	79.3	4,880
January	206	61	139	8,550
February	260	82	187	10,800
March	223	105	180	11,100
April	832	91	387	23,000
May	832	430	562	34,600
June	3,200	475	1,860	111,000
July	2,520	800	1,560	95,900
August	865	299	553	34,000
September	299	120	174	10,400
The year	3,200	42	512	372,000

PINE CREEK AT FREMONT LAKE OUTLET, WYO.

Location.—In sec. 22, T. 34 N., R. 109 W., at old Indian ford one-third mile below outlet of Fremont Lake, in Fremont County.

Drainage area.—114 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—July 22, 1910, to June 30, 1912; October 11, 1915, to September 30, 1916. From April 2, 1905, to October 31, 1906, a station was maintained half a mile downstream. Records at two points not comparable as two ditches divert water between.

Gage.—Chain on cantilever arm on left bank.

Discharge measurements.—Made from cable near gage or by wading.

Channel and control.—Bed composed of small boulders; rough but apparently permanent. No well-defined control. Banks not subject to overflow.

Extremes of discharge.—Data too meager for publication.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—One ditch diverts water above station.

Regulation.—None. Fremont Lake is approximately 8 square miles in area.

Accuracy.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve not well defined. Gage read at irregular intervals. Discharge for days on which gage was read ascertained by applying gage height to rating table; for other days estimated by comparison with records of flow at Pinedale. Records fair.

Discharge measurements of Pine Creek at Fremont Lake outlet, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 30	R. H. Fletcher	1.84	140
Aug. 4	H. K. Smith	2.31	353

Daily discharge, in second-feet, of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	110	54	30	38	62	[a]151	[a]1,130	384	[a]75
2	110	53	[a]30	38	66	152	[a]1,160	374	[a]73
3	110	52	[a]30	38	70	172	1,150	363	73
4	108	51	[a]30	38	[a]75	190	1,140	353	72
5	106	50	[a]30	39	[a]88	200	1,130	342	71
6	106	49	[a]30	40	98	200	[a]1,120	[a]330	70
7	100	[a]48	29	40	109	200	1,120	330	69
8	100	46	[a]28	40	120	225	[a]1,120	[a]330	69
9	100	44	28	40	[a]130	275	[a]1,060	[a]340	68
10	100	[a]42	27	40	[a]130	[a]330	[a]1,080	335	68
11	[a]100	[a]40	26	40	[a]148	[a]380	1,070	[a]330	67
12	100	40	25	40	[a]148	391	1,050	308	67
13	100	39	24	40	148	402	1,040	287	66
14	100	38	24	40	148	[a]413	1,020	266	66
15	[a]100	37	23	40	[a]148	500	1,000	245	65
16	100	36	22	[a]40	148	725	960	[a]224	[a]65
17	[a]100	35	21	[a]40	[a]148	925	920	216	64
18	[a]88	[a]34	20	[a]40	148	1,100	880	208	62
19	[a]75	[a]34	[a]20	[a]40	148	1,080	840	199	60
20	75	[a]33	[a]20	[a]40	[a]148	1,060	780	190	[a]59
21	[a]75	32	[a]20	40	148	[a]1,050	720	181	56
22	[a]75	31	[a]20	[a]40	147	[a]1,040	620	[a]172	52
23	[a]75	[a]30	20	41	147	1,020	[a]556	[a]165	[a]49
24	68	[a]30	20	42	146	[a]998	538	[a]165	47
25	61	[a]30	20	44	146	975	[a]520	[a]151	45
26	[a]55	[a]30	18	45	145	1,000	478	[a]151	44
27	55	[a]30	18	46	145	1,020	[a]435	138	42
28	[a]55	[a]30	18	[a]48	144	1,040	425	126	[a]40
29	[a]55	[a]30	18	52	[a]144	1,070	415	113	[a]40
30	55	30	18	57	[a]144	1,100	405	100	39
31	[a]55	....	18	....	148	....	394	88	....

[a] Gage read.

Monthly discharge of Pine Creek at Fremont Lake outlet, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	110	55	86.2	5,300
November	54	30	38.6	2,300
December	30	18	23.4	1,440
January	....	....	[a]19.6	1,210
February	....	....	[a]33.3	1,920
March	....	....	[a]35.9	2,210
April	57	38	41.5	2,470
May	148	62	130	7,990
June	1,100	151	646	38,400
July	1,160	394	848	52,100
August	384	88	242	14,900
September	75	39	60.1	3,580
The year	1,160	....	184	134,000

[a] Same as for Pine Creek at Pinedale.

PINE CREEK AT PINEDALE, WYO.

Location.—In sec. 4, T. 33 N., R. 109 W., a quarter of a mile below bridge at Pinedale, Fremont County. No large tributary between station and mouth, 3 miles below.

Drainage area.—128 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—May 8, 1915, to September 30, 1916. From April 2, 1905, to October 31, 1906, a station was maintained 1 mile below outlet of Fremont Lake, and from July 22, 1910, to June 30, 1912, one-third mile below lake outlet. Flow at different points not directly comparable as several ditches divert water between.

Gage.—Vertical staff on left bank one-fourth mile below highway bridge and vertical staff on downstream side of bridge; read by forest ranger.

Discharge measurements.—Made from two-span bridge or by wading a short distance below gage.

Channel and control.—Bed composed of coarse gravel and small boulders which may shift during high water. Control 100 feet downstream from gage at small rapids which are practically permanent. Banks not subject to overflow except at extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 4.2 feet June 20 and 21 (discharge, 1,750 second-feet); minimum discharge, 6 second-feet January 28–30.

Ice.—Stage-discharge relation somewhat affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Pine Creek between station at Fremont Lake outlet and Pinedale, and 4 second-feet below Pinedale.

Regulation.—None. Fremont Lake, which is approximately 8 square miles in area, drains 110 square miles.

Accuracy.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined between 30 and 1,000 second-feet; determinations of flow above 1,000 second-feet possibly subject to some error. Gage read to hundredths twice daily. Daily discharge, except for periods indicated in footnote to daily-discharge table, ascertained by applying daily gage height to rating table. Records good except those for winter period and for high water, which are fair.

Discharge measurements of Pine Creek at Pinedale, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Fert.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher	1.68	117	May 30	R. H. Fletcher	[c] 1.68	112
Jan. 11	R. I. Meeker	[a] 1.34	23.1	June 16	.....do	[d] 3.10	762
Feb. 20	R. H. Fletcher	[a] 1.32	33.8	Aug. 5	H. K. Smith	2.32	323
Apr. 26	Robert Follansbee	[b] 1.34	52				

[a] Stage-discharge relation affected by ice.
[b] Gage on highway bridge read 1.31.
[c] Gage on highway bridge read 1.56.
[d] Gage on highway bridge read 2.75.

Daily discharge, in second-feet, of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	123	51	20	10	20	28	38	80	118	1,460	410	104
2	123	48	31	14	28	38	43	87	114	1,460	361	98
3	123	46	32	20	28	38	39	82	118	1,460	361	96
4	123	45	25	28	28	33	38	80	135	1,460	338	87
5	118	44	23	28	28	50	39	85	152	1,460	317	84
6	114	43	22	20	38	44	40	114	140	1,560	361	80
7	114	43	22	20	38	39	40	127	140	1,460	338	77
8	114	43	22	14	50	33	40	136	165	1,380	338	72
9	114	45	22	20	50	32	48	140	206	1,380	317	70
10	114	45	19	20	50	32	56	165	277	1,380	338	67
11	114	43	20	20	38	32	49	165	317	1,420	317	61
12	104	42	26	20	38	40	46	165	384	1,330	317	57
13	104	38	19	20	28	31	46	165	435	1,330	317	56
14	104	35	19	28	20	32	51	165	490	1,200	277	53
15	95	34	18	28	20	31	64	165	650	1,200	258	51
16	95	32	16	20	20	33	56	165	722	1,060	241	50
17	86	29	19	14	28	30	48	133	760	1,150	224	51
18	84	30	17	14	28	31	49	127	1,100	840	209	48
19	83	29	14	20	28	32	50	116	1,560	840	194	45
20	80	29	14	28	38	32	50	118	1,750	722	179	44
21	78	28	14	20	38	31	50	118	1,750	582	165	43
22	76	28	20	20	38	32	49	118	1,560	550	165	40
23	72	28	20	28	38	36	50	118	1,380	490	165	38
24	69	27	14	38	38	37	50	118	1,280	435	152	38
25	66	28	14	38	38	46	50	122	925	435	140	36
26	64	26	14	20	38	40	53	118	970	410	140	34
27	62	20	14	10	38	43	58	116	1,020	410	122	32
28	58	20	20	6	28	38	63	118	1,200	384	118	32
29	58	14	14	6	28	38	69	116	1,380	384	114	29
30	55	14	14	6	....	42	77	118	1,460	410	114	28
31	54	....	10	10	....	39	....	110	....	384	114	....

NOTE.—Because of ice, discharge Nov. 27-30, Dec. 19–Mar. 3, estimated from daily gage heights, discharge measurements, observer's notes, and weather records. Discharge Oct. 5, 24, Nov. 7, Apr. 5, 9, 16, June 4, Aug. 18–20, interpolated, as gage was not read. Shifting-control method used Nov. 1–25 and July 11 to Aug. 17.

Monthly discharge of Pine Creek at Pinedale, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	123	54	91.6	5,630
November	51	14	34.2	2,040
December	31	10	19.0	1,170
January	38	6	19.6	1,210
February	50	20	33.3	1,920
March	50	28	35.9	2,210
April	77	38	50.0	2,980
May	165	80	125	7,690
June	1,750	114	752	44,700
July	1,560	384	981	60,300
August	410	114	243	14,900
September	104	28	56.7	3,370
The year	1,750	6	204	148,000

BOULDER CREEK NEAR BOULDER, WYO.

Location.—In sec. 4, T. 32 N., R. 108 W., at Sandlin ranch, 2 miles northwest of Boulder, in Fremont County. No tributary between station and mouth, 2 miles below.

Drainage area.—112 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—April 23, 1904, to October 31, 1906; May 10, 1915, to September 30, 1916.

Gage.—Vertical staff on left bank 60 feet northwest of ranch house; read by Lewis Sandlin. Gage used 1904 to 1906 was a short distance farther upstream. Records obtained from the two gages are not comparable as high water cut a new channel and changed control.

Discharge measurements.—Made by wading or from bridge 1¾ miles downstream.

Channel and control.—Bed composed of gravel; deep pool at gage. Control 150 feet downstream at rapids; somewhat shifting. Banks high and not subject to overflow. Stage of zero flow, 0.3 foot.

Extremes of discharge.— Maximum stage recorded during year, 5.5 feet at 7 a. m. June 18 (discharge, 2,420 second-feet); minimum stage, 0.48 foot for 14 days in September (discharge, 7.4 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 47 second-feet from Boulder Creek, all above station.

Regulation.—None.

Accuracy.—Stage-discharge relation shifts between narrow limits; affected by ice during winter. Rating curve well defined between 8 and 500 second-feet, above which it is based on one current-meter measurement at 1,950 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Boulder Creek near Boulder, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	R. H. Fletcher..........	1.52	140	May 29	R. H. Fletcher..........	1.60	144
Jan. 10	R. I. Meeker...........	[a] 1.65	35.0	June 16	........do..............	4.90	1,950
Feb. 20	R. H. Fletcher..........	[a] 2.70	38.4	Aug. 5	H. K. Smith............	1.26	75
Apr. 26	Robert Follansbee.....	1.11	80				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Feb.	Apr.	May.	June.	July.	Aug.	Sept.
1	184	30				152	334	700	144	12
2	187	30				147	352	808	114	12
3	190	30			33	141	352	1,100	109	12
4	190	30			49	130	447	925	91	12
5	190	30			56	155	700	865	85	11
6	175	29			46	155	925	808	83	11
7	160	30			49	264	925	808	81	11
8	148	30			56	352	1,040	808	94	11
9	135	30			87	408	1,240	808	98	10
10	130	30	35		73	467	1,510	753	102	10
11	130	28			87	488	1,650	700	92	8
12	130	26			64	488	1,580	600	80	8
13	106	21			67	408	1,510	509	75	8
14	84				43	334	1,440	488	92	8
15	84				63	281	1,650	467	61	8
16	84				78	264	2,020	509	54	8
17	84				102	230	2,260	509	41	7.4
18	81				87	164	2,340	509	32	7.4
19	75				63	170	2,340	488	29	7.4
20	70			38	53	130	2,180	380	24	7.4
21	68				46	158	1,720	334	26	7.4
22	67				53	188	1,170	281	22	7.4
23	51				49	208	753	230	18	7.4
24	51				58	214	649	230	16	7.4
25	46				49	230	808	204	15	7.4
26	41				54	230	926	152	13	7.4
27	41				64	208	1,170	102	13	7.4
28	41				96	161	1,300	198	12	7.4
29	41				130	147	1,440	182	12	7.4
30	36				144	167	1,440	167	12	7.4
31	30					247		167	12	

NOTE.—Gage read Nov. 14 to Dec. 31; discharge not computed because of ice. Gage not read Jan. 1 to Apr. 2.

Monthly discharge of Boulder Creek near Boulder, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	190	30	101	6,210
November 1–13	30	21	28.8	742
April 3–30	144	33	67.6	3,750
May	488	130	241	14,800
June	2,340	334	1,270	75,600
July	1,100	102	510	31,400
August	144	12	56.5	3,470
September	12	7.4	8.79	523

PINEY CREEK BASIN.

NORTH PINEY CREEK NEAR MARBLETON, WYO.

LOCATION.—In sec. 19, T. 31 N., R. 113 W., 300 yards above head gate of North Piney canal and 20 miles northwest of Marbleton, in Lincoln County. No large tributary within several miles.

DRAINAGE AREA.—58 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—May 30, 1915, to October 8, 1916, when station was discontinued.

GAGE.—Lallie water-stage recorder on left bank 300 yards above head gate of North Piney canal.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet below gage.

Channel and control.—Bed composed of gravel. Control 100 feet downstream at small rapids; apparently permanent. Banks not subject to overflow. Stage of zero flow, 1.2 feet.

Extremes of discharge.—Maximum stage recorded during the year, 4.98 feet at noon June 19 (discharge, 613 second-feet); minimum discharge probably occurs during winter.

Ice.—Stage-discharge relation seriously affected by ice. Observations discontinued.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 8 second-feet from North Piney Creek above the station and 209 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph. Records excellent except for period in which recorder was not used. See footnote to daily discharge table.

Discharge measurements of North Piney Creek near Marbleton, Wyo., during the period Oct. 1, 1915, to Nov. 6, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	R. H. Fletcher	2.22	30.0	June 23	H. L. Thackwell	3.86	260
June 1	....do	2.96	92	30	....do	4.13	320
16	H. L. Thackwell	4.47	430	Nov. 6	H. K. Smith	2.07	19.0

Daily discharge, in second-feet, of North Piney Creek near Marbleton, Wyo., for the period Oct. 1, 1915, to Oct. 8, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	33		35	95	311	84	34	28
2	32		40	94	316	80	33	28
3	32		60	95	322	78	32	28
4	32		79	105	273	78	32	28
5	30		110	142	256	74	31	29
6	30		120	161	261	73	30	30
7	29		110	185	252	68	30	28
8	28		50	208	243	88	30	28
9	28		30	234	234	73	29	
10	28		40	278	218	68	29	
11	27		26	322	201	62	29	
12	27		30	353	183	57	29	
13	27		35	402	175	54	29	
14	27		45	424	169	52	28	
15	27		60	430	167	53	28	
16	26		70	424	155	54	32	
17	26	46	75	480	146	52	37	
18	26	40	70	539	139	51	30	
19	26	35	70	591	126	48	38	
20	26	32	74	550	112	49	36	
21	26	70	88	469	99	50	31	
22	26	110	98	339	98	46	31	
23	26	150	99	263	92	44	29	
24	26	180	98	237	92	44	30	
25		170	84	250	106	43	30	
26		150	79	285	106	42	30	
27		150	68	327	101	41	30	
28		120	65	386	98	40	31	
29		95	70	365	92	39	30	
30		70	80	336	89	37	29	
31			90		88	35		

Note.—No record Oct. 25 to Apr. 16. No gage readings Apr. 18, 19, 21 to May 3, 5–10, 12–17, and Aug. 28 to Sept. 20; discharge estimated by comparison with records of flow of Cottonwood Creek near Big Piney.

Monthly discharge of North Piney Creek near Marbleton, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1-24	33	26	28.0	1,330
April 17-30	180	32	101	2,800
May	120	28	69.1	4,250
June	591	94	312	18,600
July	822	88	172	10,600
August	88	35	56.7	3,490
September	39	28	31.2	1,860

MIDDLE PINEY CREEK NEAR BIG PINEY, WYO.

Location.—In sec. 30, T. 30 N., R. 113 W., at Black's ranch, 15 miles west of Big Piney, in Lincoln County. No large tributary within several miles.

Drainage area.—46 square miles (measured on Pl. I, Bull. 543).

Records available.—April 1, 1915, to September 30, 1916. State engineer maintained station at Budd's ranch during 1914.

Gage.—Vertical staff on left bank 200 feet below house; read by Mrs. Orlin Black. Prior to 1916 gage was 1 mile downstream at C. P. Budd's ranch, about sec. 24, T. 30 N., R. 114 W.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Bed composed of gravel. Control 50 feet below gage at small rapids; permanent during 1916. Banks not overflowed except during extremely high water.

Extremes of discharge.—Maximum stage recorded during the year, 1.50 feet at 6 a. m. and 7 p. m. June 20 and 6.30 a. m. June 21 (discharge, 134 second-feet); minimum flow occurred during the winter, when observations were discontinued.

Ice.—No data for present site.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 34 second-feet from Middle Piney Creek above the station and 72 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined below 100 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

Discharge measurements of Middle Piney Creek near Big Piney, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	R. H. Fletcher	[a] 1.02	4.5	June 17	R. H. Fletcher	1.16	86
Apr. 24	Robert Follansbee	.54	26.3	Aug. 7	H. K. Smith	.74	42.1
May 31	R. H. Fletcher	.32	12.4				

[a] Read on gage 1 mile downstream from site of present gage.

Daily discharge, in second-feet, of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.8	....	23	12	88	51	22
2	9.8	....	15	12	91	46	22
3	9.8	....	16	12	98	44	23
4	9.8	....	18	14	92	45	23
5	9.8	....	18	26	86	42	22
6	9.8	....	21	40	79	44	22
7	9.8	....	27	40	73	40	21
8	9.8	....	26	38	82	56	20
9	9.8	....	28	42	77	42	19
10	13.0	....	26	50	73	38	19
11	16.0	....	22	55	66	36	18
12	15.0	....	21	55	66	34	17
13	16.0	....	18	55	62	32	17
14	16.0	....	18	57	65	31	16
15	16.0	....	17	59	66	29	16
16	16.0	....	16	68	67	28	15
17	16.0	....	16	84	68	24	15
18	16.0	....	15	98	59	24	14
19	15.0	....	14	112	54	23	14
20	14.0	....	15	134	47	24	13
21	14.0	....	15	126	49	26	12
22	14.0	....	16	112	47	29	12
23	14.0	....	14	91	45	30	12
24	....	25	13	84	43	27	12
25	....	28	12	81	42	24	11
26	....	29	12	79	42	23	11
27	....	32	12	82	43	23	11
28	....	37	12	90	47	23	11
29	....	35	12	98	46	22	11
30	....	32	12	98	42	22	11
31	....	....	12	....	48	22	....

NOTE.—Discharge interpolated July 4-6, and Sept. 14-17, as gage was not read. No record Oct. 24 to Apr. 23.

Monthly discharge of Middle Piney Creek near Big Piney, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1-23	16	9.8	13.0	593
April 24-30	37	25	31.1	432
May	28	12	17.2	1,060
June	134	12	66.8	3,970
July	98	42	62.8	3,860
August	56	22	32.4	1,990
September	23	11	16.1	958

LABARGE CREEK BASIN.

LABARGE CREEK NEAR LABARGE, WYO.

LOCATION.—In sec. 29, T. 26 N., R. 113 W., at Welty's ranch, 3 miles west of Labarge, in Lincoln County. No large tributary between station and mouth, 6 miles below.

DRAINAGE AREA.—176 square miles (measured on Pl. I, Bull. 543).

RECORDS AVAILABLE.—April 1, 1915, to November 8, 1916, when station was discontinued. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on right bank 250 feet downstream from highway bridge at Welty's ranch; read by Samuel Welty.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

Channel and control.—Bed composed of gravel. Control 50 feet downstream at gravel bar; shifted somewhat during 1916. Right bank high and not subject to overflow; left bank low and covered with dense underbrush; is overflowed during high water. Stage of zero flow, about 0.70 foot.

Extremes of discharge.—Maximum discharge recorded during the year, 302 second-feet on May 6 and 7; minimum discharge probably occurred during winter.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 185 second-feet from Labarge Creek above station and 103 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve not well defined. Gage read to hundredths twice daily. Daily discharge ascertained by shifting-control method. Records fair.

Discharge measurements of Labarge Creek near Labarge, Wyo., during the period Oct. 1, 1915, to Nov. 8, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Oct. 11	R. H. Fletcher	1.40	69	June 3	R. H. Fletcher	2.71	228
				Nov. 3	H. K. Smith	1.90	90
1916.							
Apr. 22	Robert Follansbee	2.03	153				

Daily discharge, in second-feet, of Labarge Creek near Labarge, Wyo., for the period Oct. 1, 1915, to Nov. 8, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	88	64		280	236	170	154	110	82	98
2	76	64	98	269	236	170	110	98	82	98
3	76	63	104	269	236	170	110	98	88	93
4	76	64	115	269	247	170	110	98	88	98
5	76	64	115	291	247	159	110	98	88	98
6	76	64	115	302	258	137	110	98	93	98
7	71	62	115	302	274	137	110	98	93	98
8	71	62	120	291	274	137	110	98	88	93
9	71	61	120	302	274	137	110	98	88	
10	71		120	302	280	126	110	98	88	
11	68		126	291	296	126	110	98	88	
12	71		126	280	286	115	110	98	88	
13	71		126	269	264	104	98	98	88	
14	72		132	247	258	104	98	93	88	
15	74		142	247	258	104	98	92	88	
16	74		142	236	252	126	98	91	88	
17	71		148	236	252	120	98	90	88	
18	70		170	236	247	115	98	88	88	
19	70		170	236	247	126	93	82	88	
20	70		170	236	247	126	98	82	88	
21	70		148	236	242	115	98	82	88	
22	68		148	236	230	126	93	82	88	
23	68		181	236	214	115	93	82	88	
24	68		181	236	214	115	98	82	93	
25	67		192	236	203	115	93	82	93	
26	66		203	236	192	115	98	82	93	
27	66		247	236	181	115	110	82	93	
28	66		247	225	181	126	110	82	93	
29	64		247	214	181	126	110	82	93	
30	64		258	214	181	115	110	82	98	
31	64			225		126	110		98	

Note.—Discharge interpolated Apr. 19, May 20-23, July 17, and Sept. 15-17, as gage was not read. No record Nov. 10, 1915, to Apr. 1, 1916.

Monthly discharge of Labarge Creek near Labarge, Wyo., for the period Oct. 1, 1915, to Nov. 8, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
October	88	64	70.8	4,350
November 1-9	64	61	68.1	1,130
1916.				
April 2-30	258	98	156	8,970
May	302	214	256	15,700
June	296	181	240	14,300
July	170	104	129	7,930
August	154	93	105	6,460
September	110	82	90.8	5,400
October	98	82	89.5	5,500
November 1-8	98	93	96.8	1,540

FONTENELLE CREEK BASIN.

FONTENELLE CREEK NEAR FONTENELLE, WYO.

Location.—About sec. 3, T. 24 N., R. 113 W., at bridge at Holden's ranch, on stage road from Opal to Big Piney, 5 miles west of Fontenelle, in Lincoln County. No large tributary between station and mouth.

Drainage area.—224 square miles (measured on Pl. I, Bull. 543).

Records available.—May 16, 1915, to September 30, 1916. State engineer maintained station at this point during 1914.

Gage.—Vertical staff on downstream side of right abutment of bridge; read by Mrs. Howard Holden.

Discharge measurements.—Made from single-span bridge or by wading below bridge.

Channel and control.—Bed composed of coarse gravel. Control at small rapids 100 feet below gage; shifts occasionally. Banks may be overflowed during extremely high water.

Extremes of discharge.—Maximum stage recorded during the year, 2.05 feet at 5.35 p. m. April 28 (discharge, 565 second-feet); minimum discharge probably occurs during winter.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 78 second-feet from Fontenelle Creek; part above station not known.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve not well defined. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage height to rating table; shifting-control method used May 4 to June 15. Records good except those for high stages, which are fair.

Discharge measurements of Fontenelle Creek near Fontenelle, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	R. H. Fletcher	0.40	35.6	June 19	R. H. Fletcher	1.65	406
Apr. 21	Robert Follansbee	1.05	189	Aug. 8	H. K. Smith	.64	79
June 3	R. H. Fletcher	1.25	232				

Daily discharge, in second-feet, of Fontenelle Creek near Fontenelle, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	27		76	367	233	150	73	50
2	39	27		104	386	233	144	69	50
3	39	27		98	330	216	138	69	50
4	39	27		84	421	233	130	65	42
5	42	27		104	517	341	138	69	34
6	39	27		98	493	378	144	69	34
7	39	31		80	549	378	130	69	34
8	39	34		91	485	378	116	73	34
9	39	34		91	501	398	96	87	34
10	39	34		159	497	441	91	69	60
11	34	34		367	437	445	91	65	42
12	34	50		330	378	449	87	65	34
13	34	20		258	378	413	80	60	34
14	34			223	304	398	80	60	34
15	37			330	233	402	87	54	34
16	37			367	233	425	116	54	37
17	34			348	200	425	91	60	37
18	34			406	200	425	87	54	34
19	34			311	216	425	87	54	34
20	34			190	184	386	69	50	34
21	34		190	190	216	348	69	60	34
22	34		159	223	233	330	69	60	34
23	34		190	258	268	311	69	60	34
24	34		190	406	268	258	69	50	37
25	34		130	425	268	240	87	50	34
26	34		80	445	216	240	69	50	34
27	34		60	505	200	206	69	50	54
28	31		130	565	200	206	69	50	54
29	31		116	525	168	206	73	50	65
30	31		91	425	200	150	69	47	69
31	27		50		216		69	60	

Monthly discharge of Fontenelle Creek near Fontenelle, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	42	27	35.5	2,180
November 1–13	50	20	30.7	792
March 21–31	190	50	126	2,750
April	565	76	269	16,000
May	549	168	315	19,400
June	449	150	331	19,700
July	150	69	94.6	5,820
August	87	47	60.5	3,720
September	69	34	40.5	2,410

BIG SANDY CREEK BASIN.

BIG SANDY CREEK NEAR FARSON, WYO.

Location.—In sec. 18, T. 27 N., R. 106 W., half a mile above head gate of Eden canal, 14 miles north of Farson, in Sweetwater County. No tributary within several miles of station.

Drainage area.—322 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—May 10, 1915, to September 30, 1916.

Gage.—Vertical staff on left bank half a mile above head gate of Eden canal, near Ten Trees; read by J. G. Hendreschke.

Discharge measurements.—Made by wading at control.

Channel and control.—Bed composed of sand which may shift. Control 100 feet downstream; permanent during 1916. . Creek overflows banks at stage of 3.7 feet. Stage of zero flow, 1.0 foot.

Extremes of discharge.—Maximum stage recorded during year, 4.8 feet at 10 a. m. June 24 (discharge not determined); minimum discharge occurs during winter.

Ice.—No information.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 38 second-feet from Big Sandy Creek above station and 4 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during 1916. Rating curve fairly well defined between 70 and 250 second-feet; extended above 250 second-feet and may be considerably in error. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for high water, which are roughly approximate.

Discharge measurements of Big Sandy Creek near Farson, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 7	R. H. Fletcher	2.00	79
May 28	do	2.42	150
Aug. 3	H. K. Smith	2.01	82

Daily discharge, in second-feet, of Big Sandy Creek near Farson, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	146	340	440	116	63	16	156	640	244	57	44
2	178	390	390	99	64	17	178	740	267	60	37
3	167	365	365	92	64	18	178	740	244	63	30
4	146	365	390	99	64	19	200	690	211	65	22
5	178	490	340	92	64	20	222	690	200	67	23
6	290	590	315	116	64	21	244	665	200	70	23
7	290	490	340	92	64	22	267	590	189	61	24
8	440	540	315	84	64	23	315	540	189	52	25
9	415	590	290	78	64	24	290	490	146	43	47
10	415	640	278	84	64	25	302	390	135	34	69
11	390	690	315	99	64	26	278	440	146	40	91
12	390	690	267	84	61	27	222	490	135	46	113
13	365	565	315	78	58	28	222	490	156	52	135
14	315	540	267	65	55	29	244	490	189	57	114
15	256	590	222	62	51	30	290	440	178	59	93
						31	315	......	135	61	......

Note.—Discharge interpolated Aug. 17–20, 22–24, 26–28, 30-Sept. 1, 3–5, 7–10, 12–14, 16–18, 20–22, 24–27, 29–30, as gage was not read.

Monthly discharge of Big Sandy Creek near Farson, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May	440	146	268	16,500
June	740	340	547	32,500
July	440	135	252	15,500
August	116	34	71.8	4,410
September	135	22	60.6	3,610
The period	......	......	......	72,500

BLACKS FORK BASIN.

BLACKS FORK NEAR URIE, WYO.

Location.—In sec. 23, T. 16 N., R. 115 W., at highway bridge 4 miles northwest of Urie, in Uinta County. No tributary within 10 miles.

Drainage area.—261 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—August 21, 1913, to September 30, 1916.

Gage.—Vertical staff on downstream side of center pier of bridge; read by Joseph Anderson. Datum lowered 0.50 foot August 19, 1915, to avoid negative readings.

Discharge measurements.—Made from two-span bridge or by wading at point 100 feet downstream.

Channel and control.—Bed composed of well-compacted gravel. Control at small rapids just below bridge; practically permanent during 1916. Right bank high and not subject to overflow; left bank subject to overflow at gage height about 3 feet. Stage of zero flow, 0.3 foot.

Extremes of discharge.—Maximum stage recorded during year, 2.7 feet from 7 p. m. June 11 to 7 p. m. June 12 (discharge 710 second-feet); minimum discharge probably occurred during winter.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 599 second-feet from Blacks Fork, all above station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 10 and 1,000 second-feet. Gage read twice daily, chiefly to tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Blacks Fork near Urie, Wyo., during the year ending Sept. 30, 1916.

[Made by H. K. Smith.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 17	1.68	245
Aug. 10	.44	7.2

Daily discharge, in second-feet, of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	59	22	....	46	193	420	23	8	2
2	62	22	....	54	182	420	23	8	2
3	38	22	....	70	193	465	23	8	2
4	46	22	....	88	241	488	23	9	2
5	51	22	....	79	258	560	23	10	2
6	46	20	....	88	276	560	23	11	2
7	45	64	....	88	465	560	19	13	2
8	43	62	....	88	560	585	14	16	2
9	36	62	....	98	510	660	14	14	3
10	36	62	....	79	465	660	14	9	3
11	32	64	....	88	420	685	14	6	3
12	42	56	131	70	398	710	14	6	3
13	38	46	193	70	182	660	11	6	3
14	40	46	155	62	62	660	11	4	2
15	45	46	155	79	88	635	26	4	2
16	32	46	155	70	155	585	25	4	2
17	33	46	155	70	208	465	22	4	1
18	42	46	155	98	224	420	18	4	1
19	40	46	155	88	241	420	18	4	1
20	40	54	148	70	258	420	17	4	1
21	40	....	119	70	241	420	16	4	1
22	32	....	124	88	193	420	13	3	1
23	32	....	124	109	152	420	12	2	3
24	33	....	119	119	128	420	10	2	3
25	31	....	117	131	117	398	8	2	3
26	27	....	119	155	128	295	8	2	3
27	25	....	106	155	179	171	8	2	2
28	22	....	109	168	241	81	8	3	2
29	22	....	88	193	295	41	8	4	2
30	22	....	62	182	535	23	8	4	2
31	22	....	46	....	488	....	8	3	....

NOTE.—Discharge July 17 to Aug. 13, estimated as stage was below gage.

Monthly discharge of Blacks Fork near Urie, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	62	22	37.2	2,290
November 1-20	64	20	43.8	1,740
March 12-31	193	46	127	5,040
April	193	46	97.1	5,780
May	560	62	267	16,400
June	710	23	458	27,300
July	26	8	15.5	953
August	16	2	5.90	363
September	3	1	2.10	125

BLACKS FORK AT GRANGER, WYO.

LOCATION.—In sec. 29, T. 19 N., R. 111 W., at highway bridge in Granger, Sweetwater County; just below mouth of Hams Fork.

DRAINAGE AREA.—2,840 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

RECORDS AVAILABLE.—May 16 to August 5, 1916, when station was discontinued.

GAGE.—Chain gage on downstream side of single-span bridge; read twice daily by M. J. Miller.

DISCHARGE MEASUREMENTS.—Made from bridge.

Data inadequate for determination of discharge; channel blocked by tie jam during almost entire period of records.

Discharge measurements of Blacks Fork at Granger, Wyo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 20	Robert Follansbee	....	1,220	June 5	R. H. Fletcher	4.83	1,380
May 16	H. K. Smith	3.01	1,310	Aug. 9	H. K. Smith	1.96	96

Daily gage height, in feet, of Blacks Fork at Granger, Wyo., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1	....	4.24	....	1.95	16	....	5.30	1.95	....
2	....	4.99	3.05	1.55	17	....	5.50	1.85	....
3	....	5.49	3.10	1.15	18	2.59	5.25	3.25	....
4	....	4.64	3.15	.85	19	2.39	5.10	3.40	....
5	....	4.39	3.05	.75	20	2.45	4.85	2.20	....
6	....	4.70	2.85	....	21	2.59	4.40	2.95	....
7	....	5.50	2.60	....	22	2.64	4.25	2.75	....
8	....	5.70	2.50	....	23	2.59	4.15	2.70	....
9	....	6.30	3.00	....	24	2.59	4.15	2.60	....
10	....	6.35	2.75	....	25	2.74	4.10	3.00	....
11	....	6.45	2.65	....	26	2.74	3.75	2.60	....
12	....	6.55	2.60	....	27	2.54	3.35	2.55	....
12	....	6.00	2.30	....	28	2.44	3.00	2.50	....
14	....	6.00	2.10	....	29	2.49	2.95	2.00	....
15	....	5.70	2.00	....	30	2.49	3.10	2.05	....
					31	2.94	....	2.00	....

HENRYS FORK BASIN.

HENRYS FORK NEAR LINWOOD, UTAH.

Location.—In sec. 30, T. 3 N., R. 21 E., at Finch's ranch 3 miles from Linwood, in Uinta County and 48 miles south of Green River, Wyo.

Drainage area.—Not measured.

Records available.—April 19 to September 30, 1916, when station was discontinued.

Gage.—Vertical staff on left bank 200 yards below observer's house; read by Miss Nora Finch.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Bed composed of compacted gravel. Control is a small riffle 50 feet below gage. Banks low; subject to overflow during high water.

Extremes of discharge.—Maximum stage recorded during year, 4.1 feet at 5 p. m. May 10 (discharge, 313 second-feet); minimum stage, 2.6 feet for periods in July and September (discharge about 2 second-feet).

Ice.—No data.

Diversions.—Prior to July 1, 1914, there were adjudicated diversions of 84 second-feet from Henrys Fork.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curve well defined between 30 and 250 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table; shifting-control method used April 19 to May 21. Records good.

Discharge measurements of Henrys Fork near Linwood, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 15	H. K. Smith...........	3.45	139	June 21	R. H. Fletcher.........	3.40	111
June 6	R. H. Fletcher.........	3.80	208	Aug. 11	H. K. Smith...........	2.96	36.0

Daily discharge, in second-feet, of Henrys Fork near Linwood, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1....	....	97	181	43	33	12	16....	....	125	122	10	33	12
2....	....	88	207	30	33	12	17....	....	112	122	10	36	12
3....	....	106	144	30	33	8	18....	....	101	122	10	33	12
4....	....	97	122	30	97	4	19....	39	80	112	10	33	12
5....	....	106	133	30	33	4	20....	39	79	112	2	21	12
6....	....	138	220	19	61	4	21....	33	86	112	2	21	4
7....	....	161	181	10	61	4	22....	46	66	112	2	21	4
8....	....	212	156	10	46	4	23....	39	84	93	2	21	4
9....	....	226	168	10	33	4	24....	39	75	75	2	16	4
10....	....	282	207	10	33	4	25....	54	66	58	10	12	8
11....	....	282	220	10	33	8	26....	54	58	58	14	12	12
12....	....	226	194	10	33	12	27....	54	66	66	19	12	12
13....	....	199	144	10	33	12	28....	54	58	58	36	8	12
14....	....	174	144	10	21	12	29....	70	93	58	138	16	16
15....	....	127	144	10	27	12	30....	106	133	43	97	12	21
							31....	....	168	....	33	12	....

Monthly discharge of Henrys Fork near Linwood, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 19-30..	106	33	52.2	1,240
May..	282	58	128	7,870
June..	220	43	130	7,740
July..	138	2	21.6	1,330
August..	97	8	29.9	1,840
September..	21	4	9.1	541
The period..	....	....	....	20,600

YAMPA RIVER BASIN.

YAMPA RIVER NEAR MAYBELL, COLO.

Location.—In sec. 2, T. 6 N., R. 95 W., on highway bridge 3 miles east of Maybell, in Moffat County. Nearest tributary, Lay Creek, enters about a mile above.

Drainage area.—3,410 square miles (measured on map issued by General Land Office).

Records available.—April 25 to September 30, 1916. From April 17, 1904 to October 31, 1905 and June 12, 1910 to November 30, 1912, a station was maintained at Thornburg bridge 9 miles below Maybell.

Gage.—Chain on upstream side of bridge, 55 feet from west abutment; read by Dr. L. B. Wheeler.

Discharge measurements.—Made from two-span highway bridge.

Channel and control.—Bed composed of small boulders and gravel. Control not well defined; probably permanent. Banks high; not likely to be overflowed.

Extremes of discharge.—Maximum stage recorded during period, 6.9 feet at 6 p. m., May 11 (discharge, 11,700 second-feet); minimum stage recorded, 0.35 foot at 10 a. m., September 7 (discharge, 329 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—There are court decrees for diversion of 618 second-feet from Yampa River above station and 82 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined between 150 and 12,000 second-feet. Gage read to quarter-tenths twice daily. Discharge determined by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Yampa River near Maybell, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 24	C. C. Hezmalhalch	3.61	3,860	Aug. 9	C. C. Hezmalhalch	1.38	1,020
May 8	do	6.12	9,750	Sept. 29	do	.40	354
June 19	do	4.78	6,440				
24	Follansbee and Hezmalhalch	3.36	3,710				

Daily discharge, in second-feet, of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		5,620	7,190	2,960	815	461	16		5,400	6,500	970	890	367
2		4,360	7,420	2,810	704	479	17		4,360	6,060	890	740	379
3		4,360	6,960	2,660	740	402	18		3,980	6,280	890	668	384
4		3,800	6,730	2,380	704	356	19		3,620	6,280	890	740	379
5		4,360	7,190	2,000	740	329	20		3,980	6,280	852	600	362
6		5,840	7,890	1,880	890	384	21		5,180	5,840	740	528	356
7		7,420	6,960	1,760	1,010	384	22		6,500	5,180	668	485	362
8		9,390	5,620	1,650	1,140	356	23		6,280	4,360	634	473	345
9		10,400	5,620	1,650	970	356	24	3,980	5,180	3,820	600	449	356
10		11,500	5,180	1,650	890	437	25	4,960	5,180	3,280	568	419	362
11		11,500	6,730	1,650	890	852	26	5,970	6,060	3,620	568	407	367
12		9,910	6,960	1,540	815	668	27	6,960	5,620	3,620	568	384	402
13		8,370	6,960	1,430	778	600	28	7,890	5,180	3,280	600	362	362
14		8,130	6,960	1,180	852	485	29	8,610	5,620	3,280	600	379	356
15		6,730	7,420	1,050	1,050	384	30	8,370	6,060	3,280	970	402	358
							31		6,500		704	479	

Note.—Discharge interpolated Apr. 25–26, June 19, 24, and Sept. 25.

Monthly discharge of Yampa River near Maybell, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 24–30	8,610	3,980	6,680	92,600
May	11,500	3,620	6,340	390,000
June	7,890	3,280	5,760	343,000
July	2,960	568	1,290	79,300
August	1,140	362	690	42,400
September	852	329	413	24,600
The period				972,000

SAVERY CREEK AT SAVERY, WYO.

Location.—About in sec. 8, T. 12 N., R. 89 W., half a mile east of Savery in Carbon County. No tributary between station and mouth, 1½ miles below.

Drainage area.—354 square miles (measured on base map of Wyoming compiled by United States Gelogical Survey, scale, 1 to 500,000).

Records available.—May 1, 1915, to September 30, 1916.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 63 second-feet from Savery Creek.

Regulation.—None.

Cooperation.—Complete records furnished by State engineer of Colorado.

Discharge measurements of Savery Creek at Savery, Wyo., during the year ending Sept. 30, 1916.

[Made by C. C. Hezmalhalch.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 20	1.41	288	July 9	−.20	13.0
May 12	1.60	360	Aug. 10	.27	48.0
June 10	.99	189	Sept. 18	−.12	17.9

Daily discharge, in second-feet, of Savery Creek at Savery, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	15	52		150	696	264	25	25	16
2	10	15	52		150	650	250	19	9	13
3	10	15	46		139	696	222	19	9	11
4	10	15	46		150	743	208	16	11	11
5	10	15	65		139	793	208	13	11	13
6	10	15	58		139	768	183	9	9	16
7	15	15	65		129	650	183	11	13	16
8	15	27	65		110	562	183	13	16	19
9	15	27	65		129	482	183	19	22	25
10	15	27	65		183	446	183	19	25	22
11	15	27	65		326	429	172	19	19	19
12	15	39	65		376	394	172	19	16	16
13	27	39	65		376	326	160	13	13	16
14	39	39			342	250	160	16	16	11
15	39	39			342	250	139	19	19	11
16	39	39			359	235	129	13	25	9
17	33	39			359	208	119	19	22	13
18	15	33			429	196	110	13	22	13
19	27	33		250	412	183	100	11	22	16
20	15	33		264	376	160	92	11	19	19
21	6	33		250	280	482	83	9	16	16
22	10	33		235	310	412	83	13	13	13
23	15	39		222	412	376	83	7	19	13
24	15	33		222	501	310	68	5	13	16
25	15	39		196	606	295	68	3	19	13
26	15	46		183	818	250	68	3	25	19
27	10	46		196	896	235	54	5	25	16
28	21	46		208	896	208	48	7	19	13
29	10	46		196	793	208	48	11	22	13
30	10	46		150	696	208	48	11	19	13
31	15			110		235		22	19	

Monthly discharge of Savery Creek at Savery, Wyo., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	30	6	17.0	1,050
November	46	15	31.8	1,890
December 1-13	65	46	59.5	1,530
March 19-31	264	110	206	5,310
April	896	110	377	22,400
May	793	160	398	24,500
June	264	48	136	8,090
July	25	3	13.3	818
August	25	9	17.8	1,090
September	25	9	15.0	892

MUDDY CREEK NEAR BAGGS, WYO.

Location.—About in sec. 33, T. 13 N., R. 91 W., at highway bridge 1½ miles northeast of Baggs, in Carbon County. No tributary between station and mouth, a mile below.

Drainage area.—904 square miles (measured on base map of Wyoming compiled by United States Geological Survey, scale 1 to 500,000).

Records available.—May 4, 1915, to August 10, 1916.

Gage.—Chain on upstream side of single-span bridge; read by Mrs. A. Blackmore.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Bed composed of sand and mud; will probably shift. Banks subject to overflow during extremely high water. Control shifting.

Ice.—No information; observations discontinued during winter.

Diversions.—Prior to December 31, 1916, there were adjudicated diversions of 3 second-feet from Muddy Creek above station.

Regulation.—None.

Cooperation.—Complete records furnished by State engineer of Colorado.

Discharge measurements of Muddy Creek near Baggs, Wyo., during the year ending Sept. 30, 1916.

[Made by C. C. Hezmalhalch.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 14	2.39	63	July 4	0.30	3.6
May 11	2.75	76	Aug. 10	2.48	78
June 8	.98	20.5	Sept. 17	.19	2.4

Daily discharge, in second-feet, of Muddy Creek near Baggs, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.
1	44	90	....	83	78	66	0.2	40
2	40	77	....	64	76	61	.0	50
3	58	56	....	62	73	44	.0	78
4	67	58	....	61	71	40	.2	106
5	77	32	....	54	78	32	1.0	396
6	87	15	....	52	76	22	1.0	270
7	99	12	....	44	74	16	1.0	220
8	102	12	....	46	73	15	.8	224
9	87	13	....	50	74	10	.5	412
10	84	10	....	52	80	6.0	1.0	99
11	72	6.5	314	52	82	6.0	1.0	....
12	58	5.8	327	48	85	3.0	.8	....
13	54	6.5	381	49	87	2.5	.5	....
14	52	5.8	375	59	76	1.0	.5	....
15	46	3.5	356	69	71	1.5	1.0	....
16	54	4.2	369	80	68	1.0	1.0	....
17	60	4.2	381	80	59	1.5	1.0	....
18	96	3.0	399	78	44	.8	1.0	....
19	102	.8	375	74	101	1.0	.8	....
20	122	.0	372	76	354	1.0	.8	....
21	122	.0	287	80	312	2.0	.5	....
22	90	.0	183	87	297	1.5	.8	....
23	159	0	146	85	254	1.0	.5	....
24	159	.0	157	85	249	.8	1.0	....
25	139	.0	157	76	236	.5	1.0	....
26	77	.0	148	74	216	.2	1.0	....
27	96	.0	140	73	202	.2	1.0	....
28	93	.0	105	82	193	.2	.5	....
29	122	.0	99	80	105	.2	.5	....
30	179	.0	92	76	92	.2	1.0	....
31	122	....	92	....	83	....	.5	....

Monthly discharge of Muddy Creek near Baggs, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	179	40	90.9	5,590
November	90	.0	13.8	821
March 11-31	399	92	250	10,400
April	87	44	67.7	4,030
May	354	44	130	7,990
June	66	.2	11.3	672
July	1.0	.0	.72	44.3
August 1-10	412	40	190	1,130

ASHLEY CREEK BASIN.

ASHLEY CREEK NEAR VERNAL, UTAH.

Location.—In sec. 1, T. 3 S., R. 20 E., about one-fourth mile above head of power canal of Vernal Milling & Light Co., about 3¼ miles above mouth of Dry Fork, and 12 miles northwest of Vernal, Uinta County.

Drainage area.—101 square miles.

Records available.—June 6, 1914, to September 30, 1916. From October 8, 1911, to June 5, 1914, fragmentary records were obtained at the power plant, the total flow of the creek being determined by including the discharge from the tailrace. Records are also available for a point below the mouth of Dry Fork from March 15, 1900, to December 31, 1904.

Gage.—Lietz water-stage recorder on the right bank about 400 yards above diversion dam; installed April 15, 1915, at same site as vertical staff gage from which fragmentary records had been obtained since June 6, 1914. From October 8, 1911, to June 5, 1914, records were obtained at the power plant; until June 28, 1913, from a gage below the tailrace, and after June 28 from a gage above the tailrace. While the gage above the tailrace was in use supplementary readings in the tailrace were taken and the flow added to obtain the total of the creek. The gage used from March 15, 1900, to December 31, 1904, was at E. Marett's ranch about 5 miles downstream, and below Dry Fork. This gage was a vertical staff on the right bank at the wagon bridge.

Discharge measurements.—Made from cable about 75 feet upstream from gage or by wading.

Channel and control.—Bed steep and rough. Control apparently fairly permanent at present site.

Extremes of discharge.—Maximum stage recorded during the year, 4.44 feet at 7 p. m. May 8 (discharge 820 second-feet); minimum stage 1.38 feet for a few days during February and March (discharge 33 second-feet).

1911–1916: Maximum discharge recorded, 1,350 second-feet May 23, 1914; minimum discharge recorded 30 second-feet March 2, 1912, first 15 days of January, 1914, and during March, 1915.

Ice.—Stage-discharge relation apparently not seriously affected by ice.

Diversions.—Above all diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent during year. Rating curve fairly well defined from 30 to 400 second-feet. Water-stage recorder out of commission several times during year but stage during these periods was fairly steady. Records good except those for February and March, which are only fair.

Discharge measurements of Ashley Creek near Vernal, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	L. W. Jordan	1.64	76.4	May 28	W. E. Dickinson	2.84	327
Jan. 15	Lynn Crandall	1.42	39.4	29	.....do	2.85	348

Daily discharge, in second-feet, of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	93	68	48	40	36	....	48	227	381	143	112	70
2	93	68	50	40	36	....	50	227	327	141	100	69
3	91	68	50	40	36	....	50	227	340	135	98	69
4	91	68	48	40	36	....	48	301	396	133	100	69
5	91	67	46	40	36	....	48	381	452	131	95	67
6	93	67	46	39	36	....	46	480	409	127	104	65
7	91	67	46	39	36	....	46	525	368	125	95	65
8	91	66	45	39	35	....	44	570	381	123	91	65
9	89	64	44	39	35	....	45	555	423	123	91	64
10	84	62	44	39	35	....	48	585	396	133	86	64
11	84	59	45	39	35	....	51	540	340	131	86	64
12	84	57	45	39	33	33	54	495	327	119	84	64
13	86	57	45	39	33	36	57	381	327	116	84	64
14	84	57	45	39	....	42	61	354	288	114	108	62
15	82	57	45	39	....	50	61	276	276	118	89	61
16	80	57	45	39	....	51	67	263	276	110	84	59
17	80	57	45	39	....	51	88	276	264	112	84	57
18	82	57	45	39	....	53	102	263	251	110	82	57
19	84	56	45	38	....	51	102	314	251	106	81	57
20	82	54	45	38	....	51	98	368	227	104	81	56
21	82	54	45	38	....	51	98	396	216	102	80	54
22	80	54	45	38	....	51	106	423	200	100	79	56
23	80	53	44	38	....	53	119	381	191	98	78	56
24	80	51	44	38	....	48	174	340	182	97	77	54
25	74	48	42	38	....	51	209	288	174	95	76	54
26	74	48	42	38	....	51	251	276	163	95	75	54
27	70	48	42	38	....	51	301	301	159	95	74	54
28	70	48	42	38	....	51	381	340	157	95	73	54
29	69	48	42	36	....	51	314	381	153	95	72	53
30	69	48	40	36	....	51	251	466	147	95	71	51
31	69	....	40	35	....	51	....	466	....	97	70	....

NOTE.—Discharge interpolated Oct. 28 to Nov. 7, Jan. 11–15, 22, and Aug. 21 to Sept. 2 when recording gage was not operating. Discharge Feb. 14 to Mar. 11 estimated at 33 second-feet.

Monthly discharge of Ashley Creek near Vernal, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	93	69	82.4	5,070
November	68	48	57.8	3,440
December	50	40	44.7	2,750
January	40	35	38.5	2,370
February	36	....	34.0	1,950
March	53	....	43.3	2,660
April	381	44	114	6,780
May	585	227	376	23,100
June	452	147	281	16,700
July	143	95	114	7,010
August	112	70	85.8	5,280
September	70	51	60.3	3,590
The year	585	....	111	80,700

DUCHESNE RIVER BASIN.

DUCHESNE RIVER AT MYTON, UTAH.

Location.—In the NW. ¼ sec. 25, T. 3 S., R. 2 W., Uinta special base and meridian, at highway bridge at Myton, Duchesne County, 3 miles below mouth of Lake Fork and 15 miles above mouth of Uinta River.

Drainage area.—2,750 square miles.

Records available.—October 26, 1899, to November 30, 1910; July 26, 1911, to September 30, 1916.

Gage.—Chain gage on upstream rail near the left end of steel highway bridge; installed August 6, 1910, at a new datum; readings about 2.7 feet lower than those on old gage; read by Abe Smith. From October 26, 1899, to June 6, 1909, a chain gage was used at an old wooden bridge about half a mile below present site. June 6, 1909, the river cut a new channel and a new chain gage was installed July 9, 1909, about a quarter of a mile upstream and at a different datum. August 9, 1909, this gage was replaced by another chain gage about 100 feet downstream on right bank but at same datum.

Discharge measurements.—Made from the highway bridge or by wading about 100 feet below the bridge.

Channel and control.—Stream bed of coarse gravel; banks comparatively low but not likely to be overflowed, although they are subject to erosion during high water. Current comparatively swift and makes an angle with the bridge at low stages. Control probably a gravel bar at the ford 100 or 200 feet below the gage; apparently fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 5.70 feet at 3.50 p. m. June 11 (discharge 4,560 second-feet); minimum stage 1.60 feet for several days in August and September (discharge 200 second-feet).

1899-1916. Maximum discharge recorded, 9,560 second-feet July 6, 1907; minimum discharge recorded, 100 second-feet August 28 to September 1, 1915.

Ice.—River generally frozen more or less completely over from middle of December to middle of March. Determinations of mean flow are based on two current meter measurements and study of weather records.

Diversions.—Much of the low-water flow of the river and its tributaries is diverted for irrigation above the station.

Regulation.—Annual run-off is affected by storage in the United States Reclamation Service dam on Strawberry River, one of the main tributaries.

Accuracy.—Stage-discharge relation permanent except during winter. Rating curve fairly well defined. Gage read twice daily. Daily discharge ascertained by applying daily gage height to rating table. Open-water records good; winter records roughly approximate.

Discharge measurements of Duchesne River at Myton, Utah, during the year ending Sept. 30, 1016.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec-ft.*
Nov. 5	L. W. Jordan	1.87	346	May 26	W. E. Dickinson	3.30	1,450
Jan. 14[a]	Lynn Crandall	2.61	355	June 6	.....do	5.58	4.550
23[b]	.....do	2.84	425	Aug. 27	E. S. Borgquist[c]	1.65	230

[a] River frozen over for two-thirds of its width at gage and at control. Floating mush ice.

[b] Frozen over except for 25 feet in mid-channel.

[c] Federal court water-commissioner.

Daily discharge, in second-feet, of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	635	335	410	......	......	670	1,900	3,280	995	500	240
2	710	335	410	......	......	710	1,700	3,000	955	500	210
3	670	310	385	......	......	725	1,800	2,705	940	530	220
4	600	295	385	......	......	750	1,950	3,250	855	565	200
5	530	285	440	......	......	750	2,225	3,940	790	955	220
6	500	285	440	......	......	670	2,520	4,285	750	805	240
7	500	440	440	......	......	635	2,900	4,110	670	870	235
8	500	500	440	......	......	620	3,180	3,860	650	910	200
9	470	470	440	......	......	620	3,320	4,195	670	790	235
10	410	530	385	......	......	695	3,545	4,470	725	565	250
11	385	310	385	......	......	855	3,395	4,565	670	500	285
12	440	285	360	......	......	955	2,900	3,780	580	440	250
13	440	285	335	......	......	910	2,705	3,545	550	490	260
14	500	260	385	355	......	870	2,520	3,700	530	470	285
15	500	310	385	......	......	885	2,205	3,620	515	515	250
16	530	385	335	......	1,040	970	2,080	3,470	620	440	260
17	440	345	360	......	1,130	1,040	1,800	3,395	580	395	260
18	440	385	285	......	1,315	1,130	1,650	2,970	635	410	275
19	470	385	285	......	1,315	1,150	1,650	2,835	530	335	260
20	440	410	285	......	1,315	1,060	1,600	2,640	450	360	240
21	440	410	310	......	1,410	1,020	1,525	2,280	430	310	250
22	440	470	385	......	1,315	955	1,600	1,880	430	295	285
23	440	440	500	425	1,175	1,020	1,650	1,600	430	310	335
24	440	440	500	......	1,130	1,085	1,600	1,430	385	250	360
25	410	360	385	......	910	1,220	1,580	1,315	395	240	360
26	410	385	335	......	790	1,430	1,430	1,295	470	200	335
27	410	410	385	......	790	1,700	1,430	1,240	620	260	325
28	385	385	285	......	790	1,820	1,485	1,295	710	240	285
29	385	335	335	......	830	2,205	1,680	1,150	710	260	335
30	385	410	335	......	790	2,135	2,245	1,130	650	275	335
31	335	......	335	......	710	......	2,945	......	550	250	......

NOTE.—Discharge estimated because of ice as follows: Jan. 1-31, 370 second-feet; Feb. 1-28, 400 second-feet; Mar. 1-15, 700 second-feet.

Monthly discharge of Duchesne River at Myton, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	710	335	471	29,000
November	530	260	373	22,200
December	500	285	377	23,200
January	....	....	370	22,800
February	....	....	400	23,000
March	....	....	879	54,000
April	2,200	620	1,040	61,900
May	3,540	1,430	2,150	132,000
June	4,560	1,130	2,870	171,000
July	995	385	627	38,600
August	955	200	459	28,200
September	360	200	269	16,000
The year	4,560	200	857	622,000

STRAWBERRY RIVER AT DUCHESNE,[1] UTAH.

Location.—In sec. 2, T. 4 S., R. 5 W., Uinta special base and meridian, at Winslow's ranch, about a mile west of post office at Duchesne, Duchesne County, half a mile above mouth of Indian Canyon a small tributary entering from the south, and 1½ miles above confluence of Strawberry River with the Duchesne.

Drainage area.—1,040 square miles.

Records available.—June 10, 1908, to November 30, 1910, and March 16, 1914, to September 30, 1916.

Gage.—Inclined staff installed April 12, 1914, on right bank, about 50 feet below footbridge at Winslow's house; gage datum lowered 1 foot November 5, 1915; read by E. S. Winslow. Chain gage at approximately same site, but different datum was used 1908–1910. A staff gage at the county bridge about a mile below was used from March 16 to April 11, 1914.

Discharge measurements.—Made from cable just below footbridge or by wading.

Channel and control.—Banks comparatively low; covered with underbrush; left bank subject to overflow at very high stages. Control is gravel bar; apparently fairly permanent. Stage of zero flow, about −1.0 foot.

Extremes of discharge.—Maximum stage recorded during year, 5.12 feet at 7 a. m. May 10 (discharge, 1,700 second-feet); minimum stage recorded 0.88 foot October 31 (discharge, 78 second-feet). Flow of 60 second-feet or less probably occurred in January.

1908–1916: Maximum discharge recorded, 1,860 second-feet April 22, 1910; minimum discharge, 30 second-feet November 20, 1914. Records obtained prior to 1914 for incomplete years only.

Ice.—Stage-discharge relation generally affected by ice from December to March. Estimates of winter flow based on discharge measurements and study of weather records.

Diversions.—Water stored in Strawberry Valley reservoir (capacity, 250,000 acre-feet), about 40 miles above station, is diverted by means of a tunnel to the Spanish Fork drainage basin. Some water is also diverted from the upper end of Strawberry Valley to the basin of Provo River.

Regulation.—Since 1912 flow of river has been affected by operation of Strawberry Valley reservoir.

Accuracy.—Stage-discharge relation shifted, presumably during spring high water; affected by ice December 13 to March 16. Rating curves fairly well defined between 50 and 1,200 second-feet. Gage read to hundredths twice daily; readings on supplementary gage used in obtaining daily mean July 24, 28, and August 4, on account of storms. Discharge ascertained by applying daily gage height to rating table; shifting-control method used May 11 to June 4. See footnote to daily-discharge table. Records fair.

Discharge measurements of Strawberry River at Duchesne, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 5	L. W. Jordan	[a] 0.92	79.3	June 5	W. E. Dickinson	[e] 3.02	686
Jan. 12	Lynn Crandall	[b] 1.35	64.4	Aug. 5	E. S. Borgquist [f]	1.97	346
24	do	[c] 1.70	75.7	Sept. 15	do	1.09	101
May 25	W. E. Dickinson	[d] 3.47	847				

[a] Datum lowered 1.00 foot.
[b] Riffle frozen over.
[c] River frozen over at gage; riffle open for about 4 feet.
[d] Stock runway of logs 6 feet below gage extends 15 feet out from bank.
[e] Stock runway removed.
[f] Federal court water commissioner.

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[1] Described in report for 1910 as "Strawberry River at Theodore, Utah."

Daily discharge, in second-feet, of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	83	81	91	....	237	1,120	763	275	194	114
2	81	81	85	....	237	1,120	725	275	182	110
3	81	81	85	....	252	1,120	725	261	194	106
4	81	81	85	....	252	1,210	725	261	613	106
5	81	83	91	....	237	1,290	687	261	275	106
6	83	98	101	....	252	1,470	687	234	220	106
7	85	156	112	....	228	1,510	687	234	220	106
8	91	120	97	....	237	1,600	650	234	335	106
9	95	120	91	....	237	1,650	613	234	220	106
10	95	101	81	....	268	1,650	613	247	182	106
11	95	101	72	....	284	1,500	613	234	177	106
12	91	101	72	....	300	1,370	540	220	158	106
13	85	106	....	....	350	1,240	540	207	158	106
14	85	145	....	....	333	1,200	540	207	247	106
15	89	112	....	....	367	1,040	540	220	158	106
16	91	101	....	....	402	998	504	234	163	106
17	91	97	....	350	420	918	486	234	163	106
18	91	124	....	333	513	958	486	207	158	96
19	91	112	....	420	513	998	469	207	154	96
20	91	112	....	475	456	958	434	194	136	96
21	85	97	....	438	402	958	434	187	136	96
22	85	91	....	438	402	918	417	182	136	96
23	85	97	....	438	456	958	400	182	125	96
24	85	97	....	420	494	958	384	367	125	96
25	85	112	....	316	630	918	367	182	119	96
26	85	112	....	268	750	879	351	182	114	96
27	85	97	....	252	831	840	335	207	114	96
28	81	85	....	300	1,040	801	320	504	114	96
29	81	85	....	268	1,250	801	304	320	114	96
30	81	91	....	237	1,250	763	290	220	119	96
31	78	....	....	228	....	763	....	182	114	....

NOTE.—Discharge estimated on account of ice: Dec. 13–31, 61 second-feet; Jan. 1–31, 66 second-feet; Feb. 1-29, 85 second-feet; Mar. 1–16, 268 second-feet.

Monthly dischare of Strawberry River at Duchesne, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	95	78	86.2	5,300
November	156	81	103	6,130
December	112	....	71.7	4,410
January	....	....	66.0	4,060
February	....	....	85.0	4,890
March	475	....	305	18,800
April	1,250	228	463	27,600
May	1,650	763	1,110	68,200
June	763	290	521	31,000
July	367	182	239	14,700
August	613	114	182	11,200
September	114	96	102	6,070
The year	1,650	....	279	202,000

LAKE FORK NEAR MYTON, UTAH.

Location.—In sec. 21, T. 3 S., R. 2 W., Uinta special base and meridian, 100 yards below highway bridge, half a mile above the confluence of Lake Fork with Duchesne River, and 3½ miles northwest of Myton, Duchesne County. From 1900–1903 this station was known as Lake Creek at mouth.

Drainage area.—468 square miles.

Records available.—July 3, 1900, to December 31, 1903; June 13, 1907, to November 30, 1910; July 26, 1911, to September 30, 1916.

Gage.—Inclined staff installed September 13, 1912, on left bank at cable; read by J. R. Bywater and Taylor Beasley. From July 3, 1900, to June 30, 1907, records were obtained from a vertical staff gage near mouth of creek at an old bridge, which was washed out with the gage July 1, 1907. A chain gage installed August 18, 1907, on right bank about 250 feet below site of old bridge, at new datum, was used until December 31, 1907; in March, 1908, it was moved upstream about a quarter of a mile and installed at new datum on right bank, just below cable. This gage was moved to the left bank and established at same datum June 22, 1909, and used until August 10, 1912, when the chain was stolen. A temporary gage was used by the observer until September 12, 1912, when the present inclined staff was installed at the same site and datum as gage stolen August 10.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Banks perpendicular and comparatively high. Stream bed of gravel and control fairly permanent. Stage of zero flow about 0.9 foot.

Extremes of discharge.—Maximum stage recorded during year, 5.2 feet at 9 a. m. June 6 (discharge, 1,300 second-feet); minimum stage 0.89 foot July 24 (discharge probably zero).

1900–1903 and 1907–1916: Maximum discharge recorded, June 7, 1912, 3,050 second-feet; minimum discharge recorded July 24, 1916, probably zero.

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, discharge measurements, and weather records.

Diversions.—No diversions below station; several canals of the United States Indian Office and some privately owned canals divert water above for irrigation.

Regulation.—Flow affected by irrigation diversions above.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 4 and 1,400 second-feet. Gage read to hundredths once daily except during winter and early spring when it was read on alternate days. Daily discharge ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by ice (see note to table of daily discharge). Records obtained by use of rating table excellent; other records good.

Discharge measurements of Lake Fork near Myton, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 4	L. W. Jordan	1.72	52.9	May 25	W. E. Dickinson	1.80	62.0
Jan. 14[a]	Lynn Crandall	2.80	94.3	June 7	.....do	4.48	948
23[b]	.....do	3.15	126	Aug. 27	E. S. Borgquist[c]	1.15	31.0

[a] Complete ice cover at gage and control.
[b] Conditions about the same as on Jan. 14.
[c] Federal court water commissioner.

Daily discharge, in second-feet, of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	385	67			174	179	743	18	16	14
2	575	54	139		179	204	535	12	28	12
3	372	54	146		174	230	496	4	22	8
4	168	54	153		168	204	873	9	22	9
5	156	58	160		157	230	1,250	4	22	4
6	148	58	162		146	273	1,300	4	51	14
7	117	70	163		142	347	1,060	22	135	12
8	117	82	158		139	421	964	28	102	16
9	117	88	154		154	421	1,200	1	93	7
10	98	88	135		168	516	1,300	4	24	9
11	98	74	116		204	458	1,250	4	18	9
12	117	64	96		180	421	830	4	16	14
13	117	67		288	156	372	830	4	21	12
14	98	115		298	222	322	919	4	17	11
15	98	155		308	288	273	830	4	33	12
16	98	189		319	246	226	874	1	22	14
17	98	184		319	204	179	874	.9	18	11
18	98	152		319	217	146	700	.6	21	12
19	117	119		319	230	114	743	.6	21	13
20	117			319	199	82	575	0	18	13
21	117			312	184	66	351	0	18	13
22	107			304	170	51	258	6	11	15
23	107			296	174	54	156	.8	4	15
24	107	121		288	179	58	74	0	4	12
25	107			273	184	68	35	8	4	11
26	98			258	189	60	35	6	2	10
27	82			244	172	51	36	51	3	8
28	82			212	156	104	51	26	9	10
29	82			179	217	156	41	15	10	10
30	82			174	198	385	30	16	12	11
31	74			168		616		14	14	

NOTE.—Discharge estimated because of ice from observer's notes, weather records, and two discharge measurements as follows: Nov. 20–23, 135 second-feet; Nov. 25 to Dec. 1, 130 second-feet; Dec. 13–31, 105 second-feet; Jan. 1–31, 120 second-feet; Feb. 1–29, 110 second-feet; and Mar. 1–12, 200 second-feet. Discharge interpolated for days when gage was not read.

Monthly discharge of Lake Fork near Myton, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	575	74	140	8,610
November	189	54	108	6,430
December			120	7,380
January			120	7,380
February			110	6,330
March			245	15,100
April	288	139	186	11,100
May	616	51	235	14,400
June	1,300	30	640	38,100
July	51	0	8.61	529
August	135	2	26.2	1,610
September	16	4	11.4	678
The year	1,300	0	162	118,000

PRICE RIVER BASIN.

PRICE RIVER NEAR HELPER, UTAH.

Location.—In sec. 36, T. 13 S., R. 9 E., at ford about 300 feet west of Denver & Rio Grande Railroad main line at settlement locally known as Spring Glenn, 2 miles south of Helper, Carbon County, 1 mile above diversion dam of Price River Irrigation Co., and 4 miles below White Creek.

Drainage area.—530 square miles.

Records available.—February 21, 1904, to September 30, 1916.

Gage.—Vertical staff on left bank; installed July 16, 1907, to replace the old chain gage washed out April 11, 1907; read by D. S. Rowley. A temporary gage was read June 23 to July 15, 1907. All gage heights beginning June 23, 1907, are referred to a datum 0.7 foot above that of original chain gage.

Discharge measurements.—Made from cable, or by wading.

Channel and control.—Bed of the stream composed of gravel and fine sand. Control is at riffle immediately below ford; shifts occasionally during floods. Stage of zero flow, determined January 8, 1916, 1.2 feet.

Extremes of discharge.—Maximum stage recorded during year, 7.0 feet at 12.30 p. m. July 28 (discharge about 3,800 second-feet); minimum stage, 2.20 feet December 19 (discharge 21 second-feet).

1904–1916: Maximum stage recorded, 7.0 feet July 28, 1916 (discharge 3,800 second-feet); minimum stage recorded 3.1 feet (old chain gage) during December, 1905, and January, 1906 (discharge, 4 second-feet).

Ice.—Stage-discharge relation affected by ice for short periods; estimates of flow based on weather records and observer's notes.

Diversions.—Main diversions from Price River are below station. About 10,000 acre-feet of water can be stored at the Mammoth reservoir of the Price River Irrigation Co. on Gooseberry Fork, about 40 miles above station.

Regulation.—Flow of river is affected by storage at Mammoth reservoir.

Accuracy.—Stage-discharge relation permanent until floods latter part of July and early part of August. Rating curve used until July 27 well defined between 20 and 1,300 second-feet. Rating curve used July 29 to September 30 defined by one measurement. Gage read to hundredths once daily after May 10. Daily discharge ascertained by applying daily gage height to rating table. Records good until July 28; fair July 29 to September 30.

Discharge measurements of Price River near Helper, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 8	Lynn Crandall	[a] 2.38	32.2	June 10	W. E. Dickinson	4.05	497
Mar. 27	A. B. Purton	[b] 3.38	227	July 2	.....do	3.11	140
May 4	W. E. Dickinson	[c] 4.44	823	Aug. 11	.....do	[d] 3.10	120

[a] Shore ice at gage; riffle clear; no backwater.
[b] Brush and drift lodged on control.
[c] Brush lodged on riffle.
[d] Channel silted in since last visit.

Daily discharge, in second-feet, of Price River near Helper, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	31	33	31	34	......	30	210	840	685	169	276	62
2	30	33	25	28	......	30	258	800	685	146	184	65
3	33	33	31	36	......	34	258	722	615	148	195	62
4	32	33	33	34	......	......	295	800	615	143	242	65
5	33	33	36	32	33	......	258	920	615	143	210	62
6	34	46	33	34	34	......	242	1,000	582	139	225	65
7	28	85	33	34	34	38	242	1,180	582	139	225	62
8	28	70	33	35	34	36	276	1,370	550	139	210	60
9	28	44	34	34	36	56	360	1,370	490	143	168	65
10	31	46	33	33	35	76	520	1,370	490	143	139	60
11	31	40	32	32	34	113	490	1,270	462	153	117	55
12	31	24	28	32	34	85	490	1,180	434	143	132	62
13	33	33	31	34	32	94	434	1,090	383	150	143	65
14	33	32	33	34	35	104	490	1,000	383	153	156	65
15	30	30	34	34	45	114	550	920	337	163	132	65
16	31	38	33	34	44	125	582	840	316	195	156	62
17	34	36	33	34	40	173	582	760	295	251	125	62
18	34	36	28	34	38	232	550	722	276	251	121	62
19	32	34	21	34	36	308	520	685	258	190	121	62
20	33	34	27	34	34	383	408	685	251	184	134	62
21	27	36	33	32	34	360	462	685	219	179	117	62
22	33	35	24	33	36	360	434	685	219	179	99	62
23	33	35	36	36	38	582	462	685	213	179	95	130
24	33	36	32	35	36	816	550	650	201	184	88	70
25	32	36	28	34	36	258	615	615	195	184	85	70
26	30	37	33	35	41	240	615	582	184	190	85	70
27	28	35	32	......	39	222	800	550	163	225	76	67
28	29	27	31	......	37	258	880	550	143	800	73	67
29	31	36	30	......	27	276	1,000	550	143	242	67	67
30	30	38	32	......	......	238	1,000	650	143	207	99	65
31	30	......	33	......	......	182	......	650	......	213	67	......

NOTE.—Discharge estimated because of ice, as follows: Jan. 27–31, 33 second-feet; Feb. 1–4, 30 second-feet; Mar. 4–6, 32 second-feet.

Monthly discharge of Price River near Helper, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	34	27	31.2	1,920
November	85	24	38.1	2,270
December	36	21	31.2	1,920
January	36	28	33.5	2,060
February	45	27	35.2	2,020
March	582	30	175	10,800
April	1,000	210	494	29,400
May	1,370	550	851	52,300
June	685	143	372	22,100
July	800	139	195	12,000
August	276	67	141	8,670
September	130	55	66.0	3,930
The year	1,370	21	206	149,000

SAN RAFAEL RIVER BASIN.

HUNTINGTON CREEK NEAR HUNTINGTON, UTAH.

Location.—In sec. 6, T. 17 S., R. 8 E., at the Cunha ranch, about 7 miles northwest of Huntington, Emery County. Below all main tributaries except Fish Creek.

Drainage area.—158 square miles.

Records available.—May 3, 1909, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank; installed April 30, 1913, to replace the inclined staff used since October 7, 1912; set to read the same but is about 100 feet above inclined gage, which is 20 feet above cable. A vertical staff on right bank at same site and datum as inclined gage was used May 3, 1909, to October 6, 1912.

Discharge measurements.—Made by wading or from cable.

Channel and control.—Bed composed of coarse gravel; shifts occasionally during high stages.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 5.60 feet at 11 p. m. May 8 (discharge, 1,100 second-feet); minimum stage (staff), 2.30 feet at 3.20 p. m. November 12 (discharge 24 second-feet).

1909–1916: Maximum discharge 1,100 second-feet May 22 and 23, 1914, and May 8, 1916. Minimum discharge 12 second-feet March 20, 21, 22, and 23, 1912.

Ice.—Stream frozen entirely over during greater part of winter. Winter estimates based largely on study of weather records.

Diversions.—Several small ditches divert from tributaries above the station.

Regulation.—A small storage reservoir on Huntington Creek above the station controls distribution of flow to a slight extent.

Accuracy.—Stage-discharge relation shifted slightly; affected by ice November 26 to December 4 and December 12 to February 11. Rating curves well defined up to 500 second-feet, applicable October 1 to December 11, February 12 to May 5, and May 9 to September 30. Water-stage recorder generally operated satisfactorily but was not kept in use during winter. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph except for periods indicated in footnote to daily-discharge table.

Discharge measurements of Huntington Creek near Huntington, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 9[a]	Lynn Crandall	3.70	41.1	June 28	W. E. Dickinson	3.48	188
Mar. 24	A. B. Purton	2.82	64.2	Aug. 8	Dickinson and Jacob	3.25	127
May 5	W. E. Dickinson	4.40	427				

[a] Measured at ford 2 miles below gage. Frozen over at station except for narrow channel in center.

Daily discharge, in second-feet, of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	38				62	316	664	166	141	74
2	38	39				63	240	594	158	158	58
3	39	39				64	330	636	151	149	57
4	42	39			48	64	420	688	143	151	53
5	42	42	45			64	511	734	141	180	53
6	43	54	40			63	618	718	143	158	53
7	41	58	35			63	755	640	143	138	52
8	42	45	31			64	824	640	153	134	52
9	43	35	39			68	894	664	147	126	56
10	43	35	46			75	786	664	153	128	54
11	43	35	43			95	713	617	143	125	53
12	41	24		36		91	684	576	134	120	53
13	44	34				87	659	567	130	121	53
14	45	34				92	541	528	132	111	52
15	43	34				97	456	504	139	128	52
16	46	34				99	417	483	136	138	52
17	43	43				107	452	471	128	112	52
18	41	40			53	112	467	464	120	105	53
19	43	40		36		104	479	436	125	104	53
20	42	40				90	475	406	118	104	52
21	41	40				88	464	395	110	104	52
22	41	40				92	631	365	138	100	52
23	41	40				109	567	336	138	99	58
24	40	36			62	134	504	307	139	100	58
25	37	39			64	170	460	278	153	100	55
26	38			36	63	189	444	249	162	88	54
27	39				66	230	467	220	162	86	55
28	38				70	349	533	191	155	85	54
29	38				65	468	580	194	141	88	55
30	38				65	392	664	175	138	86	55
31	38				62		684		143	82	

NOTE.—Discharge estimated on account of ice as follows: Nov. 26–30, 40 second-feet; Dec. 1–4, 42 second-feet; Dec. 12–31, 38 second-feet; Jan. 1–9, 40 second-feet; Jan. 10–31, 38 second-feet; Feb. 1–11, 35 second-feet. Discharge interpolated, because water-stage recorder was out of commission as follows: Nov. 9–11, 35 second-feet; Nov. 13–16, 34 second-feet; Nov. 18–23, 40 second-feet; Feb. 13–18, and 20–25, 36 second-feet; Feb. 27–29, 38 second-feet; Mar. 1–3, 45 second-feet; Mar. 5–17, 50 second-feet; Mar. 19–23, 58 second-feet. Staff gage was read once a week Feb. 11 to Mar. 24. Shifting-control method used May 6–8.

Monthly discharge of Huntington Creek near Huntington, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	46	37	41.0	2,520
November	58		39.2	2,330
December			38.9	2,390
January			38.6	2,370
February			35.8	2,060
March	70		54.6	3,360
April	468	62	128	7,620
May	894	240	549	33,800
June	734	175	480	28,600
July	166	110	141	8,670
August	180	82	118	7,250
September	74	52	54.5	3,240
The year	894		141	104,000

HUNTINGTON CREEK NEAR CASTLEDALE, UTAH.

Location.—In sec. 33, T. 18 S., R. 9 E., about half a mile below county bridge on road to Green River, 5 miles above mouth of Cottonwood Creek, and 6 miles east of Castledale, Emery County.

Drainage area.—325 square miles.

Records available.—May 12, 1911, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank; installed May 2, 1913, at same datum as vertical staff gage which it replaced.

Discharge measurements.—Made by wading or from a cable just below gage.

Channel and control.—Bed composed of sand and small gravel. Banks fairly high; subject to erosion but not to overflow. Original control, which was formed by 2 by 12 inch planks, placed edgewise in a trench and anchored to pipes driven into stream bed, has been almost obliterated. Stage of zero flow about 0.9 foot.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 7.2 feet at 11 p. m. August 12 (discharge, 1,030 second-feet); minimum stage 1.19 feet October 1 (discharge, 6 second-feet).

1911–1916: Maximum stage recorded 7.2 feet at 11 p. m. August 12, 1916 (discharge, 1,030 second-feet); minimum stage 0.95 foot September 10, 1915 (discharge, 2.5 second-feet).

Ice.—Stage-discharge relation seriously affected by ice. Winter flow determined largely by a comparison with the records of flow for station near Huntington. Ice forms 4 or 5 feet in thickness and the stream is often ice bound until April 1.

Diversions.—Station is below all diversions in Castle Valley.

Regulation.—Flow affected by irrigation in Huntington district.

Accuracy.—Stage-discharge relation not permanent; affected by ice November 26 to March 20. Rating curve used October 1 to May 6 well defined between 5 and 350 second-feet; curve used May 10 to September 30 rather poorly defined. Operation of water-stage recorder satisfactory except during periods indicated in footnote to daily-discharge table; gage not in operation, because of ice, January 12 to March 22. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph or, for days of considerable fluctuation in stage, by averaging the hourly discharge. Open-water records good; winter records roughly approximate.

Discharge measurements of Huntington Creek near Castledale, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 11[a]	Lynn Crandall	2.85	39.0	June 29	W. E. Dickinson	1.71	37.2
Mar. 25	A. B. Purton	2.21	66.0	Aug. 9	do	1.74	40.5
May 6	W. E. Dickinson	3.91	313				

[a] Stream entirely frozen over; stage read on outside staff gage.

Daily discharge, in second-feet, of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6	8	....	47	128	338	24	15	14
2	6	8	....	46	110	277	23	16	13
3	6	9	....	46	123	277	22	16	12
4	6	10	....	46	142	311	20	26	12
5	8	10	....	46	211	430	22	45	12
6	8	66	....	45	286	374	18	50	12
7	9	128	....	55	420	311	18	34	12
8	8	36	....	57	468	302	19	70	12
9	8	....	....	71	487	311	20	40	14
10	8	....	....	86	477	320	19	30	14
11	8	....	....	103	401	302	16	23	14
12	8	....	....	109	347	268	13	206	14
13	9	....	....	105	329	260	12	222	14
14	9	....	....	112	243	233	11	65	13
15	9	27	....	126	189	209	13	56	13
16	8	29	....	134	156	193	12	87	14
17	8	27	....	141	161	198	13	67	14
18	8	29	....	92	179	179	11	56	14
19	8	31	....	86	178	174	11	46	14
20	8	32	....	84	172	....	12	42	14
21	8	32	99	99	149	....	11	37	14
22	8	31	88	85	252	....	11	29	14
23	9	29	99	92	277	....	11	25	17
24	9	30	87	119	252	....	12	....	16
25	9	23	60	142	190	....	15	....	16
26	9	....	61	134	166	60	16	....	15
27	8	....	59	161	164	52	21	....	14
28	9	....	60	211	222	44	18	....	13
29	9	....	54	268	253	36	17	....	13
30	9	....	51	198	294	30	22	....	13
31	9	....	49	....	329	....	16	....	....

NOTE.—Discharge estimated because of ice as follows: Nov. 26 to Jan. 31, 27 second-feet; Feb. 1-29, 40 second-feet; Mar. 1-10, 56 second-feet; Mar. 11-20, 112 second-feet. Water-stage recorder not in operation, discharge interpolated, as follows: Nov. 9-14, 32 second-feet; June 20-25, 117 second-feet; Aug. 24-31, 20 second-feet. Discharge June 26, 29, determined from readings on staff gage; June 27, 28, and 30, Sept. 1, 3, interpolated.

Monthly discharge of Huntington Creek near Castledale, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9	6	8.13	500
November	128	8	30.7	1,830
December	....	....	27.0	1,660
January	....	....	27.0	1,660
February	....	....	40.0	2,300
March	....	....	78.9	4,850
April	268	45	105	6,250
May	487	110	250	15,400
June	430	30	206	12,300
July	24	11	16.1	990
August	222	....	47.2	2,900
September	17	12	13.7	815
The year	487	6	70.8	51,500

SAN RAFAEL RIVER NEAR GREEN RIVER, UTAH.

Location.—In sec. 27, T. 22 S., R. 14 E., at county bridge near Tomlinson ranch, on road from Green River to Hanksville; about 16 miles southwest of Green River, Emery County.

Drainage area.—1,690 square miles.

Records available.—May 5, 1909, to September 30, 1916.

Gage.—Vertical staff on downstream side of right crib abutment of bridge; read by Mrs. W. E. Tomlinson and Mrs. L. Presset.

Discharge measurements.—Usually made from cable about 300 feet above the bridge, because of condition of bottom.

Channel and control.—Bed composed of mud and quicksand; shifting; control not well defined. Banks fairly high but left bank subject to overflow at extreme floods.

Extremes of discharge.—Maximum stage recorded during year, 9.0 feet morning of August 6 (discharge estimated 3,750 second-feet); minimum stage, 1.52 feet October 1–5 (discharge 3 second-feet).

1909–1916: Maximum stage recorded 9.0 feet September 2, 1909 (discharge 4,720 second-feet); water standing in pools during August and September, 1910, and August 13 to September 8, 1915.

Ice.—Stage-discharge relation seriously affected by ice. Winter flow determined from discharge measurements and weather records.

Diversions.—Below practically all diversions from San Rafael River. The main diversions in this basin are made from the tributaries, for irrigation in Castle Valley.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by ice December 17 to February 24. Rating curve used October 1 to November 6 and March 15 to September 30 fairly well defined between 250 and 1,000 second-feet; curve used November 8 to March 13, poorly defined. Gage read to hundredths once daily October 1 to March 30 and twice daily April 1 to September 30. Daily discharge ascertained by applying daily gage height to rating table except for periods when stage-discharge relation was affected by shifting control or ice. Records fair.

Discharge measurements of San Rafael River near Green River, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 5[a]	Lynn Crandall	2.58	51.7	May 12	W. E. Dickinson	4.98	846
Mar. 8	A. B. Purton	3.16	263	June 26	do	3.90	354

[a] River frozen except for 10-foot strip in center at gage and control.

Daily discharge, in second-feet, of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	11	44	......	70	130	258	841	258	152	90
2	3	12	43	......	90	104	258	1,080	234	152	90
3	3	12	46	......	109	104	258	1,200	234	592	90
4	3	12	48	......	128	112	284	1,320	211	1,140	77
5	3	12	94	......	128	112	472	1,380	190	1,780	77
6	3	12	97	......	146	119	532	1,380	190	1,780	77
7	3	700	83	......	806	119	592	1,390	152	311	77
8	4	368	83	......	265	144	841	1,380	135	284	65
9	5	306	83	......	252	170	1,140	1,440	234	259	65
10	6	228	83	......	450	170	1,140	1,380	311	234	65
11	7	185	83	......	648	211	898	1,440	170	190	65
12	7	172	76	......	1,080	190	841	1,380	152	391	77
13	7	159	74	......	558	190	958	1,320	152	592	84
14	7	146	73	......	1,080	190	684	1,200	119	190	77
15	7	115	72	......	592	190	510	1,200	112	258	77
16	7	112	70	......	340	170	402	1,440	104	234	77
17	8	97	......	......	402	170	386	1,380	112	234	65
18	9	76	......	......	520	190	370	786	119	211	65
19	10	70	......	......	637	190	340	841	104	200	65
20	11	70	......	......	436	170	340	592	104	190	65
21	11	75	......	......	311	190	409	472	84	170	65
22	12	76	......	......	311	200	436	402	80	152	65
23	12	77	......	......	420	211	472	402	77	152	65
24	11	78	......	......	528	234	436	394	77	135	65
25	10	80	......	128	637	234	436	386	77	127	65
26	10	80	......	116	284	311	370	370	786	97	65
27	10	82	......	104	258	311	403	326	152	90	65
28	10	70	......	93	233	472	436	284	370	90	65
29	10	58	......	82	207	472	514	271	403	90	65
30	10	48	......	......	182	436	592	284	436	90	65
31	11	......	......	......	156	......	786	......	152	90	......

NOTE.—Discharge estimated because of ice as follows: Dec. 17–31, 65 second-feet; Jan. 1–31, 58 second-feet; Feb. 1–24, 76 second-feet; Nov. 7 and Mar. 14 by indirect method for shifting control.

Gage not read, discharge interpolated Oct. 9, 10, 13, Nov. 12, 13, 23, Dec. 8, 10, 13–15, Feb. 26–29, Mar. 2, 3, 10, 18, 23, 24, 27–31, Apr. 1, 8, 22, May 6, 27, 29, June 3, 24, July 15, 22, 29, Aug. 9, 12, and 19.

Monthly discharge of San Rafael River near Green River, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	12	3	7.52	462
November	700	11	123	7,320
December	97	....	68.6	4,220
January	....	....	58.0	3,570
February	....	....	80.9	4,650
March	1,080	70	379	23,300
April	472	104	207	12,300
May	1,140	258	541	33,300
June	1,440	271	932	55,500
July	786	77	196	12,100
August	1,780	90	343	21,100
September	90	65	71.3	4,240
The year	1,780	3	251	182,000

NOTE.—Maximum discharge on Aug. 6, 3,750 second-feet.

COTTONWOOD CREEK NEAR ORANGEVILLE, UTAH.

Location.—In sec. 9 or 10, T. 18 S., R. 7 E., at Robert Johnson's ranch, about 5 miles northwest of Orangeville, Emery County.

Drainage area.—240 square miles.

Records available.—May 1, 1909, to September 30, 1916.

Gage.—Inclined staff on left bank just below corral at ranch house and about 300 feet above cable; used March 22, 1910, to November 23, 1913; and May 24, 1914, to September 30, 1916. Read by Robert Johnson. Records obtained November 24, 1913, to May 23, 1914, were referred to a different gage at independent datum installed November 20, 1913, at cable. From May 1, 1909, to August 21, 1909, stage was determined by measuring down from a nail in a tree at about the location of the present gage. August 22, 1909, an inclined staff was installed at the reference point; gage was washed out August 31, 1909, and from September 1, 1909, to March 22, 1910, the records were uncertain and unreliable. March 22 an inclined staff was installed at present site and at datum 0.8 foot lower than the datum used in 1909. An inclined staff was installed in 1911 about 400 feet below present gage but no published records have been referred to it, and it was destroyed by floods in the spring of 1913.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed rough; shifting. Banks fairly high but have been overflowed by the sudden floods, to which the stream is subject.

Extremes of discharge.—Maximum stage recorded during the year, 7.0 feet at 4 p. m. June 10 (discharge, 950 second-feet); minimum stage 4.5 feet December 13 and 15 (discharge, 18 second-feet).

1909–1916: Maximum discharge recorded, 1,980 second-feet September 7, 1913; minimum discharge recorded, 5 second-feet September 21, 1910.

Ice.—Stage-discharge relation affected by ice; winter flow estimated from discharge measurements and weather records.

Diversions.—Two or three small ditches divert water above station but all the main ditches take out below.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent until high water in June; affected by ice during winter. Rating curve used October 1 to December 31 and March 1 to May 31 fairly well defined; curve used July 23 to September 30 poorly defined. Gage read about four times a week, in the afternoon. Daily discharge for days on which gage was read ascertained by applying gage height to rating table; shifting-control method used June 1 to July 22; interpolated for other days. Records only fair owing to lack of gage readings and shifting control.

Discharge measurements of Cottonwood Creek near Orangeville Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	Lynn Crandall	4.85	31.1	May 7	W. E. Dickinson	6.12	404
Mar. 25	A. B. Purton	4.62	27.4	June 29	do	5.86	258
May 7	W. E. Dickinson	6.14	417	Aug. 9	do	4.81	65.5

[a] Frozen solid; water flowing over ice.

Daily discharge, in second-feet, of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	25	34	34	32	143	630	235	110	40
2	25	25	34	34	38	184	630	205	110	40
3	25	25	34	34	45	225	690	200	110	40
4	25	25	34	34	45	300	750	195	110	40
5	25	25	34	34	45	300	820	190	110	40
6	25	25	34	34	45	450	780	190	100	40
7	25	30	34	40	34	410	750	190	90	40
8	25	•34	34	45	34	630	890	190	85	40
9	25	34	30	51	52	690	950	180	80	40
10	25	36	25	57	70	630	950	170	75	40
11	25	18	25	57	70	570	910	160	65	40
12	25	22	22	73	70	570	890	150	65	40
13	25	25	18	70	102	570	800	150	65	40
14	25	25	18	58	70	430	800	150	65	40
15	25	25	18	45	81	300	800	155	65	40
16	25	25	34	57	92	350	800	155	65	40
17	25	25	30	45	102	350	730	160	60	35
18	25	25	35	54	85	350	660	160	55	30
19	25	25	30	62	57	350	590	165	51	30
20	25	25	34	70	61	350	530	165	51	30
21	25	25	34	70	85	350	470	160	51	30
22	25	25	34	70	121	350	415	150	51	35
23	25	25	34	57	145	350	390	150	45	40
24	25	25	34	51	167	350	365	150	40	35
25	25	25	34	45	167	350	340	150	40	30
26	25	25	34	45	214	350	315	150	40	30
27	25	25	34	45	260	350	315	150	40	30
28	25	25	34	57	260	350	315	150	40	30
29	25	25	34	41	102	450	260	130	40	30
30	25	25	34	25	122	510	250	120	40	30
31	25	....	34	25	....	630	....	110	40	....

NOTE.—Discharge estimated because of ice as follows: Jan. 1-31, 27 second-feet; Feb. 1-29, 25 second-feet.

Monthly discharge of Cottonwood Creek near Orangeville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	25	25	25.0	1,540
November	36	25	25.8	1,540
December	34	18	31.1	1,920
January	....	....	27.0	1,670
February	....	....	25.0	1,440
March	73	25	44.0	3,010
April	260	32	95.8	5,700
May	690	143	405	24,900
June	950	250	626	37,200
July	235	110	164	10,100
August	110	40	66.2	4,070
September	40	30	36.2	2,150
The year	950	18	104	95,200

FERRON CREEK (UPPER STATION) NEAR FERRON, UTAH.

LOCATION.—In sec. 1, T. 20 S., R. 6 E.; about a quarter of a mile below house at the Peterson ranch (formerly Christensen's), 1½ miles above grist mill and 5 miles northwest of Ferron, Emery County.

DRAINAGE AREA.—150 square miles.

RECORDS AVAILABLE.—May 6, 1911, to September 30, 1916.

GAGE.—Inclined staff on right bank at cable installed September 13, 1911, to replace the original vertical staff 150 feet above cable; read by Charles Carlson.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

Channel and control.—Banks high and not subject to overflow. Bed composed of sand and gravel; shifting.

Extremes of discharge.—Maximum stage recorded during year, 3.00 feet 8 p. m., June 5 (discharge, 561 second-feet); minimum stage, 0.36 foot April 6 (discharge, 16 second-feet).

1911–1916: Maximum stage recorded, 5.50 feet 4 p. m. June 1, 1914 (discharge, 1,100 second-feet); minimum discharge recorded, 1 second-foot March 22 and 23, 1912.

Ice.—Observations discontinued during winter.

Diversions.—Above all diversions except a small ditch for the Peterson ranch.

Regulation.—None.

Accuracy.—Stage-discharge relation changed radically during first half of June, owing to scouring of channel. Rating curves before and after change poorly defined. Gage read to hundredths twice daily after April 4, 1916. Discharge ascertained by applying daily gage height to rating table. Records only fair.

Discharge measurements of Ferron Creek (upper station) near Ferron, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	Lynn Crandall		9.8	Jun. 30[c]	W. E. Dickinson	0.62	166
Mar. 26[b]	A. B. Purton	0.36	16.5	Aug. 10[d]	do	[d]1.88	45.6
May 8	W. E. Dickinson	2.62	372				

[a] Creek frozen over; no gage height.
[b] Stage of zero flow at −0.5 foot ± 0.1 foot.
[c] Channel cut out to depth of about 2 feet below zero of gage.
[d] Gage datum lowered 2 feet Aug. 10.

Daily discharge, in second-feet, of Ferron Creek (upper station), near Ferron, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	12				110	328	178	310	37
2	12			19	116	328	174	69	37
3	11			18	143	340	164	182	37
4	11			20	192	403	150	202	37
5	11			19	250	470	138	152	35
6	11			16	260	484	134	98	37
7	10			19	240	470	131	81	35
8	10			22	311	498	127	70	59
9	10			35	328	526	116	65	36
10	9	10		71	333	526	113	44	35
11	9			56	284	540	109	44	34
12	9			34	284	526	106	320	32
13	9			27	226	512	98	46	31
14	9			42	198	512	92	242	30
15	9			76	176	498	89	136	29
16	9			88	164	416	89	71	28
17				68	167	403	86	63	27
18				65	192	416	78	60	25
19				54	205	390	73	59	25
20				41	203	385	65	60	24
21				48	181	355	68	58	23
22				65	226	300	65	59	23
23				130	186	288	118	57	22
24				150	169	290	70	53	21
25				186	172	265	84	50	21
26			16	172	159	261	68	48	21
27				185	164	242	218	44	22
28				203	183	234	75	42	22
29				75	220	222	68	50	22
30				108	293	188	250	40	22
31					340		65	39	

Note.—Observer absent from station Oct. 17 to Apr. 2; no record.

Monthly discharge of Ferron Creek (upper station) near Ferron, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 2-30	203	16	72.8	4,190
May	340	110	215	13,200
June	540	188	387	23,000
July	250	65	112	6,890
August	310	39	94.[illegible]	5,780
September	59	21	29.6	1,760
The period				54,800

GRAND RIVER BASIN.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

Location.—In sec. 13, T. 3 N., R. 76 W., at highway bridge 3 miles southwest of Grand Lake, in Grand County. Nearest tributary, Grand Lake outlet, enters some distance below the station; no tributaries for several miles above.

Drainage area.—101 square miles (revised, measured on topographic maps.)

Records available.—July 29, 1904, to September 30, 1909; September 20, 1910, to September 30, 1916.

Gage.—Vertical staff on downstream side of right bridge abutment; read by Mrs. Ethel M. Curry.

Discharge measurements.—Made from highway bridge at gage or by wading.

Channel and control.—Bed composed of boulders; rough. Gravity section which shifts slightly from year to year. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 5.37 feet at 7 p. m. June 16 (discharge, 666 second-feet); minimum stage, 3.37 feet February 9 and 10 (discharge, 33 second-feet).

Ice.—Stage-discharge relation only slightly affected by ice for short periods, as springs keep river open.

Diversions.—There are court decrees for the diversions of 699 second-feet from the headwaters above the station. Of this amount 525 second-feet are for diversions across the divide into the headwaters of the Cache la Poudre River; under this decree 14,518 acre-feet were diverted in 1916. There is also a reservoir decree for 19,000 acre-feet from floodwater.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent during 1916, but shifts slightly from year to year. Rating curve fairly well defined below 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

The following discharge measurement was made by T. J. Watkins: January 30, 1916: Gage height, 3.44 feet; discharge, 39.5 second-feet.

Daily discharge, in second-feet, of North Fork of Grand River at Grand Lake, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	61	48	41	36	36	34	52	225	420	322	107	56
2	59	46	39	36	36	34	52	172	395	322	90	63
3	66	45	37	36	35	34	54	135	370	300	128	60
4	64	45	38	36	34	34	55	155	420	280	197	62
5	62	43	39	36	35	34	48	190	560	260	152	74
6	61	43	38	36	34	34	41	260	472	242	128	69
7	57	43	37	37	34	34	42	345	420	214	152	72
8	57	45	36	38	34	34	45	345	370	181	142	74
9	55	46	36	36	33	34	48	445	420	214	128	76
10	55	48	37	36	33	34	55	560	560	225	111	78
11	55	48	36	37	34	34	62	445	472	242	107	78
12	55	49	37	38	35	34	69	445	420	181	94	102
13	49	49	37	38	36	34	77	395	472	152	88	107
14	55	49	38	37	34	34	80	370	530	128	107	102
15	55	49	38	36	35	34	82	300	590	152	96	84
16	55	48	38	36	34	34	80	260	652	169	88	74
17	55	48	37	37	34	34	92	242	530	169	84	74
18	55	46	36	36	34	34	113	225	590	152	88	74
19	54	45	36	36	34	37	109	197	530	148	74	72
20	54	45	36	35	34	37	105	225	500	128	69	69
21	54	45	35	36	34	38	109	242	420	107	69	67
22	52	46	35	36	34	41	109	242	500	102	65	63
23	52	46	35	36	34	53	131	260	395	102	65	63
24	52	45	35	36	34	51	155	190	322	94	65	88
25	51	42	35	35	34	51	260	260	322	88	65	78
26	51	46	36	36	34	51	242	242	322	88	65	74
27	49	49	36	35	34	50	345	260	345	88	74	74
28	48	48	37	36	34	50	300	260	322	96	65	74
29	48	45	38	36	34	50	345	260	322	102	63	74
30	48	43	37	38	....	51	300	322	322	115	63	72
31	48	....	36	38	....	51	....	370	....	128	55	....

NOTE.—Discharge Jan. 6-7, and 21-23 estimated because of ice.

Monthly discharge of North Fork of Grand River near Grand Lake, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	66	48	54.6	3,360
November	49	42	46.1	2,740
December	41	35	36.8	2,260
January	38	35	36.4	2,240
February	36	33	34.3	1,970
March	53	34	39.5	2,430
April	345	41	122	7,260
May	560	135	285	17,500
June	652	322	443	26,400
July	322	88	171	10,500
August	197	55	95.0	5,840
September	107	56	74.9	4,460
The year	652	33	120	87,000

GRAND RIVER AT HOT SULPHUR SPRINGS,[1] COLO.

Location.—In sec. 2 T. 1 N,, R. 78 W., at the bridge connecting the Denver & Salt Lake Railway station with the town of Hot Sulphur Springs, in Grand County. Nearest tributary, Beaver Creek, enters two miles below.

Drainage area.—946 square miles (measured on map in Hayden's atlas).

Records available.—July 22, 1904, to September 30, 1909; September 23, 1910, to September 30, 1916.

Gage.—Chain on downstream side of bridge; read by employee of U. S. Forest Service. A staff gage 1,000 feet farther downstream, and set to a datum 6.07 feet lower was used to April 16, 1906.

Discharge measurements.—Made from bridge, or by wading.

Channel and control.—Bed composed of well compacted gravel. Control, 150 feet downstream, shifts from year to year. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 5.45 feet on May 10 and 8 a. m. May 11 (discharge, 3,540 second-feet); minimum discharge about 103 second-feet, February 26.

Ice.—Stage-discharge relation seriously affected by ice. Winter flow estimated from discharge measurements, observers' notes, and weather records.

Diversions.—Between this station and the mouth of North Fork there are court decrees for the diversion of 96 second-feet from Grand River; also a reservoir decree for 31,300 acre-feet from the flood waters of the Grand.

Regulation.—None.

Accuracy.—Stage-discharge fairly permanent during open water periods; shifts occasionally between narrow limits; affected by ice from November 11 to March 25. Rating curve well-defined above 250 second-feet and poorly defined below. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table. Open-water records good; winter records fair.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 1	T. J. Watkins	[a]3.32	121	June 3	W. R. King	4.74	2,580
Mar. 2	W. R. King	[a]3.37	107	26	H. K. Smith	4.47	2,160
May 15	do	4.52	2,130				

[a] Stage-discharge relation affected by ice.

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[1] Called "Sulphur Springs" in previous reports.

Daily discharge, in second-feet, of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	337	176	125	138	120	110	190	1,060	2,740	1,820	735	317
2	317	174	130	153	125	105	215	975	2,880	1,700	665	300
3	317	174	135	146	132	105	357	850	2,600	1,580	605	265
4	317	176	141	138	138	120	215	772	2,740	1,360	735	263
5	357	176	146	130	141	135	210	1,160	3,160	1,360	735	280
6	280	176	153	125	144	132	198	1,160	2,740	1,160	665	357
7	263	180	153	129	141	118	190	1,820	2,460	1,060	735	357
8	230	184	146	142	134	116	165	2,330	2,330	1,060	605	298
9	246	174	138	153	128	116	202	2,880	2,460	975	578	298
10	238	176	134	156	123	125	215	3,460	3,020	1,360	605	337
11	230	174	138	150	120	138	337	3,160	3,020	1,360	497	447
12	230	162	142	130	120	162	378	2,880	3,020	1,210	472	447
13	246	153	146	130	117	246	424	2,600	3,160	975	550	472
14	215	146	148	141	114	215	357	2,600	3,160	890	550	424
15	215	138	150	142	112	170	424	2,070	3,160	810	524	424
16	230	141	138	140	110	180	436	1,700	2,880	850	498	400
17	230	150	125	135	110	215	447	1,580	3,160	810	472	337
18	230	156	116	132	109	280	550	1,260	3,310	735	378	317
19	215	167	108	134	109	357	578	1,160	3,160	735	357	298
20	215	170	105	135	112	735	472	1,360	3,310	665	357	280
21	215	180	125	132	114	447	378	1,580	3,020	605	378	263
22	215	190	153	132	114	280	472	1,580	2,880	605	357	246
23	212	190	146	132	110	280	497	1,580	2,330	550	317	246
24	198	184	135	130	105	246	700	1,360	2,070	497	317	317
25	184	167	123	129	104	215	810	1,700	1,940	497	317	337
26	192	162	110	128	103	317	1,020	2,070	2,070	497	317	357
27	208	153	105	125	107	400	932	1,940	2,070	524	317	298
28	200	138	110	124	112	424	1,260	1,940	2,200	524	317	280
29	192	132	120	125	112	298	1,580	1,820	2,200	550	298	263
30	188	125	125	123	....	230	1,700	1,820	1,940	810	298	263
31	172	....	130	122	....	180	....	2,460	....	700	420	....

NOTE.—Discharge Nov. 11 to Mar. 25 estimated because of ice. Gage not read, discharge estimated Oct. 3, 10, 17, 21, 24, Nov. 7, Mar. 28, Apr. 16, Aug. 15–16, 30–31, and Sept. 1–3.

Monthly discharge of Grand River at Hot Sulphur Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	357	172	237	14,600
November	190	125	165	9,820
December	153	105	132	8,120
January	156	122	135	8,300
February	144	103	119	6,840
March	735	105	232	14,300
April	1,700	165	530	31,500
May	3,460	772	1,830	113,000
June	3,310	1,940	2,710	161,000
July	1,820	497	930	57,200
August	735	298	483	29,700
September	472	246	326	19,400
The year	3,460	103	652	474,000

GRAND RIVER NEAR KREMMLING, COLO.

Location.—In sec. 23, T. 1 N., R. 81 W., at the entrance to Gore Canyon, 3 miles southwest of Kremmling, in Grand County. Nearest tributary, Blue River, enters a mile below Kremmling.

Drainage area.—2,380 square miles.

Records available.—July 24, 1904, to September 30, 1916.

Gage.—Friez water-stage recorder on right bank 200 feet above wagon bridge, used since October 15, 1915. Original gage, a chain on left bank, 100 feet above present site, installed July 24, 1904, and used until October 17, 1906; datum 0.80 foot lower than present. Inclined staff directly opposite chain gage, at present gage datum, used October 18, 1906, to July 27, 1910. Friez water-stage recorder installed near staff gage and at same datum used July 28, 1910, to October 14, 1915, except during winter months, when staff gage was used.

Discharge measurements.—Made from cable just above gage. Winter measurements made from bridge at head of rapids.

Channel and control.—Bed composed of sand, silt, and scattered boulders. Control is head of rapids, 250 feet downstream; shifts slightly as silt is deposited and later scoured out by high water. Banks high and not subject to overflow.

Extremes of discharge.—Maximum discharge during year, determined from comparative hydrograph, 8,100 second-feet, on June 12; minimum discharge 200 second-feet, December 27.

Ice.—Stage-discharge relation not seriously affected by ice except during occasional short periods when ice is jammed on rapids.

Diversions.—There are court decrees for the diversions of 35 second-feet from Grand River between this station and that at Hot Sulphur Springs.

Storage.—Station is at site of proposed Kremmling reservoir. A dam built 230 feet above the river bed at the mouth of Gore Canyon will impound nearly 2,200,000 acre-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts between narrow limits. Rating curve well defined between 200 and 15,000 second-feet. Operation of water-stage recorder satisfactory, except for occasional short periods; during the winter staff gage was read to hundredths twice daily. Daily discharge during open water ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph; during winter by applying to rating table mean of two daily readings of staff gage. Open-water records excellent; winter records good.

Discharge measurements of Grand River near Kremmling, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	W. R. King	[a] 2.06	651	May 17	W. R. King	8.24	3,750
Feb. 2	T. J. Watkins	1.08	316	June 7	.....do	10.16	5,510
Mar. 3	W. R. King	1.14	335	June 28	H. K. Smith	9.76	5,020

[a] Old gage 100 feet upstream read 2.02 feet.

Daily discharge, in second-feet, of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	858	545	325	425	300	365	630	2,730	5,990	4,490	2,430	1,090
2	822	515	260	455	315	365	660	2,550	6,210	4,130	2,130	975
3	822	515	328	420	328	340	765	2,250	6,100	3,970	2,080	905
4	822	515	365	390	352	328	695	2,130	6,100	3,730	2,430	905
5	788	500	405	352	378	390	660	2,250	6,650	3,490	2,550	920
6	770	515	435	352	340	435	630	2,670	6,430	3,270	2,310	940
7	740	545	435	300	328	378	600	3,570	5,460	3,130	2,550	1,050
8	710	560	405	360	340	365	570	4,760	5,700	2,990	2,190	905
9	680	530	365	415	340	378	600	5,770	6,800	3,200	2,080	870
10	680	545	325	460	328	405	630	6,880	6,880	3,340	2,080	1,050
11	650	530	305	405	328	495	835	7,120	7,500	3,410	1,880	1,330
12	680	410	328	300	328	570	1,050	6,430	8,100	3,130	1,680	1,370
13	680	356	365	315	315	660	1,130	6,100	7,500	2,730	1,880	1,330
14	650	302	378	352	290	695	1,090	5,660	7,000	2,550	2,080	1,330
15	650	328	390	365	290	600	1,090	4,960	7,000	2,370	1,980	1,210
16	680	315	350	352	315	600	1,130	4,060	7,240	2,430	1,680	1,090
17	680	328	305	340	328	660	1,170	3,650	7,480	2,490	1,580	975
18	680	378	260	315	328	765	1,370	3,130	7,600	2,430	1,450	905
19	650	420	225	328	340	835	1,490	2,850	7,600	2,310	1,330	870
20	650	495	205	328	340	975	1,830	2,920	7,720	2,130	1,250	835
21	635	480	300	290	328	1,330	1,170	3,490	7,120	1,990	1,250	800
22	635	510	450	328	340	1,050	1,210	3,490	6,540	1,830	1,170	765
23	635	510	350	365	328	975	1,450	3,340	5,770	1,730	1,090	730
24	620	495	350	352	340	870	1,780	3,130	5,160	1,630	1,060	800
25	605	405	300	365	340	730	2,080	3,570	5,060	1,580	1,010	870
26	575	450	250	340	340	730	2,430	4,400	4,960	1,580	1,060	800
27	575	405	200	328	340	695	2,730	4,310	4,960	1,680	1,050	765
28	575	288	260	340	365	765	3,060	4,310	4,960	1,980	1,010	730
29	560	250	270	325	365	870	3,570	4,400	4,960	1,880	940	695
30	545	230	325	300	......	765	3,270	4,490	4,760	2,250	940	695
31	545	......	370	285	......	630	......	5,260	......	2,610	1,130	......

NOTE.—Discharge estimated, because of ice, Nov. 13, 29–30, Dec. 1–2, 10–11, 16–21, 23–31, Jan. 1–3, 7–13, 28–31, and Feb. 1; estimated by hydrographic comparison with record of flow of Grand River at Glenwood Springs June 8–9 and 11–15; interpolated Sept. 5 and 28.

Monthly discharge of Grand River near Kremmling, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre feet).
	Maximum.	Minimum.	Mean.	
October	858	545	672	41,300
November	560	230	439	26,100
December	450	200	329	20,200
January	460	285	353	21,700
February	378	290	332	19,100
March	1,330	328	646	39,700
April	3,570	570	1,360	80,900
May	7,120	2,130	4,080	251,000
June	8,100	4,760	6,380	380,000
July	4,490	1,580	2,660	164,000
August	2,550	940	1,660	101,000
September	1,370	695	960	56,500
The year	8,100	200	1,650	1,200,000

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

Location.—In sec. 9, T. 6 S., R. 89 W., in front of electric power house at Glenwood Springs, in Garfield County. No Name Creek enters Grand River about 2 miles above station, and Roaring Fork half a mile below.

Drainage area.—4,520 square miles (measured on Nell's map of Colorado).

Records available.—January 1, 1900, to September 30, 1916; also May 12 to July 17, 1899, at point just above Roaring Fork.

Gage.—Friez water-stage recorder on right bank in front of power house. Since 1902 a number of water-stage recorders referred to datum of staff gage installed in 1900, have been used. Chain gage at railroad bridge, just above mouth of Roaring Fork used before 1900.

Discharge measurements.—Made from cable beneath the State Street bridge one-third mile below the gage.

Channel and control.—Bed composed of well compacted gravel, on which silt is deposited. Control is riffle 300 feet downstream; shifts slightly. Banks not subject to overflow except at extremely high water.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 8.95 feet at 8 a. m. June 14 (discharge, 14,800 second-feet); minimum stage, 2.45 feet at noon December 21 (discharge, 260 second-feet).

Ice.—Stage-discharge relation not affected by ice; hot water from springs keeps river open.

Diversions.—Between this station and the one near Kremmling there are court decrees for a diversion of 13 second-feet of water from Grand River for irrigation, 1,250 second-feet absolute for power, and 14,400 second-feet conditional for power.

Regulation.—The Shoshone power plant of the Colorado Power Co., 6 miles upstream, controls the flow during the day at low water, but has insufficient pondage to control it for more than a few hours.

Accuracy.—Stage-discharge relation shifts occasionally but only between very narrow limits; not affected by ice. Rating curve well-defined between 500 and 15,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table daily gage height determined by inspecting gage-height graph, or for days of considerable fluctuation, by averaging discharge for two-hour intervals. Records excellent.

Discharge measurements of Grand River at Glenwood Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	W. R. King	3.49	814	Apr. 25	W. R. King	5.53	3,690
Jan. 8	T. J. Watkins	3.24	642	June 16	.....do	8.70	13,700
Feb. 6	.....do	3.42	772	July 22	.....do	5.36	3,170

Daily discharge, in second-feet, of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,430	1,000	525	722	584	706	1,240	5,360	10,400	8,300	4,440	1,750
2	1,430	875	785	707	566	685	1,200	4,700	11,100	7,950	4,090	1,820
3	1,370	860	672	837	590	633	1,280	4,320	11,100	7,300	3,660	1,640
4	1,320	838	713	800	706	672	1,390	3,870	11,100	7,000	3,870	1,510
5	1,280	830	755	815	792	822	1,290	4,090	11,800	6,550	3,980	1,530
6	1,260	830	838	808	755	934	1,250	4,960	12,200	6,100	4,090	1,680
7	1,200	748	800	672	720	862	1,200	6,400	11,100	5,800	4,090	1,730
8	1,140	969	792	608	778	830	1,190	8,650	10,000	5,650	4,090	1,870
9	1,140	945	800	646	734	815	1,140	10,000	10,800	5,650	3,660	1,730
10	1,110	898	770	682	713	854	1,100	11,800	12,200	6,100	3,660	1,880
11	1,150	905	755	770	699	934	1,220	12,600	13,400	6,250	3,550	2,360
12	1,110	845	748	678	723	1,040	1,570	11,800	14,200	5,650	3,140	2,600
13	1,040	706	762	602	627	1.170	1,940	11,100	14,200	5,220	3,240	2,600
14	1,060	574	770	688	694	1,280	2,010	10,400	14,600	4,700	3,870	2,600
15	1,040	620	785	785	647	1,280	1,940	9,350	14,200	4,320	3,870	2,440
16	1,100	762	808	792	668	1,200	2,010	7,950	13,800	4,200	3,340	2,060
17	1,110	713	699	699	673	1,230	2,080	6,700	13,800	4,320	3,040	1,880
18	1,110	734	581	706	672	1,340	2,220	6,100	14,200	4,200	2,860	1,780
19	1,120	785	562	734	726	1,510	2,520	5,500	14,200	4,090	2,440	1,680
20	1,130	868	519	672	580	1,630	2,520	5,220	14,200	3,760	2,360	1,590
21	1,120	822	495	692	716	1,880	2,290	5,800	13,400	3,550	2,290	1,520
22	1,080	945	685	672	699	2,290	2,150	6,400	12,200	3,240	2,150	1,450
23	1,100	969	727	706	659	1,940	2,290	6,100	11,100	3,140	2,010	1,360
24	937	921	822	770	713	1,880	2,770	5,800	10,000	2,950	1,820	1,450
25	1,180	890	741	808	700	1,630	3,340	6,100	9,700	2,950	1,750	1,530
26	1,110	755	672	785	770	1,390	3,980	7,000	9,350	2,950	1,750	1,570
27	945	699	607	720	594	1,390	4,570	7,600	9,350	3,140	1,820	1,500
28	945	741	490	741	664	1,390	5,360	7,600	9,350	3,550	1,750	1,410
29	937	594	588	720	720	1,450	6,250	7,950	9,000	3,760	1,690	1,380
30	945	543	594	720	......	1,570	6,550	8,650	9,000	3,980	1,610	1,360
31	898	......	659	626	......	1,450	......	9,350	......	4,570	1,690	......

NOTE.—Discharge Oct. 17-18 estimated. Daily discharge determined by averaging discharge for two-hour intervals, Jan. 1-3, 10-14, Feb. 11-28, Mar. 26, and Apr. 2 and 5.

Monthly discharge of Grand River at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,430	898	1,120	68,900
November	1,000	543	806	48,000
December	838	490	694	42,700
January	837	602	722	44,400
February	792	566	686	39,500
March	2,290	633	1,250	76,900
April	6,550	1,100	2,400	143,000
May	12,600	3,870	7,390	454,000
June	14,600	9,000	11,800	702,000
July	8,300	2,950	4,870	299,000
August	4,440	1,610	2,960	182,000
September	2,600	1,360	1,770	105,000
The year	14,600	490	3,040	2,210,000

GRAND RIVER NEAR PALISADE, COLO.

LOCATION.—In sec. 2, T. 11 S., R. 98 W., at State bridge 2 miles above Palisade in Mesa County. Nearest large tributary, Plateau Creek, enters about 6 miles above.

DRAINAGE AREA.—8,550 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—April 9, 1902, to September 30, 1916.

Gage.—Chain on downstream side of bridge near midspan; read by Mrs. Inez Nelson.

Discharge measurements.—Made from new bridge 2 miles below gage.

Channel and control.—No information.

Extremes of discharge.—No data.

Ice.—Stage-discharge relation affected by ice; data insufficient to warrant determinations of flow.

Diversions.—Between Palisade and the station at Glenwood Springs there are court decrees for the diversion of 1,828 second-feet from Grand River, 628 second-feet of which are for irrigation, and 1,200 second-feet for power in pumping to higher levels. The proposed high-line canal of the United States Reclamation Service will divert 700 second-feet 5 miles above Palisade station.

Regulation.—None.

Cooperation.—Complete records furnished by United States Reclamation Service.

Discharge measurements of Grand River near Palisade, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 29	Page and Lund	12.6	1,660
May 13	J. C. Page	19.1	19,700
Sept. 16	Page and Blackmer	13.9	3,260

Daily discharge, in second-feet, of Grand River near Palisade, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,250	1,420	1,230		1,640	2,700	11,000	18,600	16,600	8,180	2,700
2	2,540	1,420	1,370		1,580	2,540	9,260	19,200	15,600	7,590	2,700
3	2,250	1,370	1,470		1,420	2,390	8,480	19,700	15,000	7,880	2,700
4	2,180	1,470	1,470		1,470	2,780	7,730	19,900	14,300	8,480	2,460
5	2,000	1,420	1,530		8,030	2,620	7,730	21,000	13,600	7,590	2,320
6	2,060	1,580	1,470		2,180	2,780	9,420	21,200	12,000	7,300	2,540
7	2,120	1,580	1,530		1,940	2,540	13,100	20,300	11,700	7,590	2,460
8	2,060	2,320	1,420		1,880	2,540	16,000	19,000	11,400	7,160	2,180
9	1,880	1,880	1,420		2,000	2,390	18,200	19,000	11,500	7,020	2,620
10	1,530	2,620	1,420		2,000	2,390	20,500	21,200	11,900	6,210	3,300
11	1,640	1,820	1,420		2,060	2,700	21,900	23,800	11,500	6,080	3,580
12	1,640	1,580	1,420		2,120	2,940	21,200	24,800	11,200	5,600	3,880
13	1,760	1,530	1,420		2,250	3,580	19,700	25,300	10,200	8,630	3,980
14	1,700	1,370	1,420		2,460	3,980	18,400	25,800	9,580	7,590	3,980
15	1,700	1,320	1,420		2,460	3,980	16,600	25,300	9,100	7,590	3,780
16	1,640	1,320	1,470		2,320	3,980	14,300	24,000	8,480	6,740	3,580
17	1,760	1,530	1,420		2,250	4,180	12,600	23,800	8,640	5,720	3,300
18	1,700	1,420	1,370	1,530	2,540	4,600	11,200	23,800	8,330	5,360	2,940
19	1,640	1,370	1,230	1,580	2,780	4,920	10,200	24,800	8,030	4,920	2,860
20	1,640	1,470	1,110	1,700	3,120	5,140	11,400	24,800	7,440	4,600	2,700
21	1,760	1,530	1,070	1,700	3,880	4,920	12,000	23,500	6,880	4,280	2,780
22	2,000	1,580	1,190	1,530	4,500	4,500	12,000	22,600	6,470	3,880	2,460
23	1,640	1,820	1,470	1,640	4,700	4,810	11,700	19,900	5,960	3,680	2,390
24	1,640	1,700	1,420	1,640	4,080	5,600	11,400	18,200	5,600	3,300	2,390
25	1,580	1,640	1,470	1,580	3,580	6,600	11,900	17,800	5,250	3,030	2,460
26	1,760	1,470	1,420	1,640	3,030	7,590	12,600	17,800	5,360	2,940	2,390
27	1,640	1,420	1,190	1,580	2,540	8,480	13,600	17,600	5,480	2,860	2,390
28	1,530	1,420	1,230	1,580	2,940	9,740	13,900	17,400	6,880	2,860	2,390
29	1,530	1,470	1,190	1,580	3,120	12,000	14,300	17,200	7,020	2,700	2,250
30	1,530	1,320	1,190		3,030	12,400	15,400	17,000	6,740	2,700	2,250
31	1,530		1,190		2,940		17,200		7,300	2,780	

Note.—Stage-discharge relation seriously affected by ice Jan. 1 to Feb. 17; daily discharge not determined.

Monthly discharge of Grand River near Palisade, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,540	1,530	1,800	111,000
November	2,620	1,320	1,570	93,400
December	1,530	1,070	1,360	83,600
February 18-29	1,700	1,530	1,610	38,300
March	4,700	1,420	2,640	162,000
April	12,400	2,390	4,740	282,000
May	21,900	7,730	13,700	842,000
June	25,800	17,000	21,100	1,260,000
July	16,600	5,250	9,520	585,000
August	8,630	2,700	5,580	343,000
September	3,980	2,180	2,820	168,000

GRAND RIVER NEAR FRUITA, COLO.

Location.—In sec. 20, T. 1 N., R. 2. W., at highway bridge 1½ miles south of Fruita, in Mesa County. Nearest large tributary, Little Salt Wash, enters a mile below station; Gunnison River enters at Grand Junction about 12 miles above .

Drainage area.—16.800 square miles (measured on map in Hayden's atlas).

Records available.—Flood records during 1908, 1909, and 1910; continuous records April 1, 1911, to September 30, 1916.

Gage.—Chain on downstream side of left span; read by Van Branstetter. Prior to May 3, 1911, gage was vertical staff attached to center pier, datum 0.05 foot lower.

Discharge measurements.—Made from highway bridge.

Channel and control.—Bed composed of silt and gravel; shifts during high water. Control is riffle 600 feet downstream; slightly shifting. Banks are high and will not be overflowed except at stages above 18 feet.

Extremes of discharge.—Maximum stage recorded during year, 11.2 feet June 14 and at 8 a. m. June 15 (discharge, 39,600 second-feet); minimum stage, 2.4 feet at 5 p. m. November 15 and 8 a. m. November 16 (discharge, 2,170 second-feet). Minimum discharge probably occurs during winter.

Ice.—Stage-discharge relation seriously affected by ice; daily discharge not determined during winter months.

Diversions.—Between the Palisade station and Fruita there are court decrees for diversion of 788 second-feet from Grand River.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts occasionally between narrow limits; affected by ice December 17 to February 18. Rating curve well-defined above 2,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Open-water records good; winter records fair.

Discharge measurements of Grand River near Fruita, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 17	2.56	2,350
June 18	10.78	37,700
July 21	5.76	8,880

Daily discharge, in second-feet, of Grand River near Fruita, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,290	2,300	2,430	....	2,990	5,450	19,200	28,600	21,400	11,400	4,110
2	3,290	2,430	2,700	....	2,700	4,850	16,500	30,600	20,400	11,000	3,940
3	3,290	2,300	2,700	....	2,700	5,250	14,800	29,900	19,200	12,100	3,610
4	3,140	2,430	2,560	....	2,560	5,660	14,000	31,700	18,700	12,900	3,290
5	2,990	2,430	2,840	....	3,290	5,660	15,600	33,100	17,600	12,900	3,290
6	2,990	2,430	2,990	....	4,470	5,250	17,300	33,100	16,700	11,400	3,290
7	2,990	2,560	2,990	....	3,450	5,660	22,000	32,400	16,000	12,100	3,290
8	2,990	2,990	2,990	....	3,140	4,660	27,200	32,000	15,200	11,000	3,450
9	2,840	2,840	2,700	....	3,140	4,660	31,300	28,600	15,400	10,700	3,610
10	2,700	3,290	2,700	....	3,290	4,850	34,900	30,600	15,600	10,700	4,110
11	2,300	3,140	2,700	....	3,940	5,250	38,100	34,100	15,400	10,700	5,450
12	2,430	2,990	2,700	....	3,940	6,520	35,900	37,400	14,200	10,300	5,870
13	2,430	2,700	2,700	....	4,110	7,220	33,800	38,800	12,900	10,000	5,870
14	2,430	2,300	2,700	....	4,660	7,730	31,700	39,600	12,100	11,700	5,450
15	2,560	2,170	2,700	....	4,660	7,470	27,900	39,200	11,400	12,100	5,250
16	2,700	2,300	2,700	....	4,290	7,730	23,600	37,700	11,000	11,400	5,050
17	2,560	2,300	....	....	4,290	8,270	20,400	37,000	11,000	9,710	4,850
18	2,700	2,560	....	....	4,660	9,120	17,600	38,100	11,000	8,830	4,290
19	2,700	2,700	....	2,990	4,850	10,300	16,900	38,800	10,300	8,550	4,110
20	2,700	2,700	....	3,290	5,450	10,000	18,200	38,800	9,710	8,270	3,940
21	2,560	2,700	....	2,990	6,750	8,830	20,100	35,900	8,830	6,750	3,610
22	2,700	2,990	....	2,990	10,000	8,550	20,100	33,100	8,000	6,080	3,610
23	2,560	3,140	....	2,990	8,830	9,710	20,400	30,600	7,470	5,450	3,450
24	2,700	2,990	....	2,990	8,270	11,700	19,400	26,600	6,750	4,850	3,450
25	2,560	2,990	....	3,140	7,220	14,000	18,900	25,600	6,980	4,470	3,450
26	2,560	2,990	....	2,700	6,080	15,200	20,400	25,000	6,980	4,290	3,610
27	2,560	2,990	....	2,990	5,450	16,500	21,700	24,800	8,000	4,470	3,610
28	2,560	2,840	....	3,290	5,660	18,200	22,200	24,200	8,550	4,110	3,450
29	2,430	2,700	....	3,290	5,870	21,700	22,800	23,900	10,000	3,940	3,450
30	2,430	2,430	....	....	6,080	22,200	23,900	22,800	9,710	3,940	3,450
31	2,300	....	....	....	5,870	....	26,600	....	10,300	3,770	....

NOTE.—Discharge estimated because of ice as follows: Dec. 17–31, 2,330 second-feet; Jan. 1–31, 2,650 second-feet; Feb. 1–18, 2,720 second-feet. Discharge July 12, interpolated.

Monthly discharge of Grand River near Fruita, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,290	2,300	2,710	167,000
November	3,140	2,170	2,690	160,000
December	....	....	a 2,540	156,000
January	....	....	a 2,650	163,000
February	....	....	a 2,850	164,000
March	10,000	2,560	4,920	303,000
April	22,200	4,660	9,270	552,000
May	38,100	14,000	23,000	1,410,000
June	39,600	22,800	32,100	1,910,000
July	21,400	6,750	12,500	769,000
August	12,900	3,770	8,710	536,000
September	5,870	3,290	4,040	240,000
The year	39,600	....	9,000	6,530,000

a Estimated by hydrographic comparison with record of flow of Grand River at Glenwood Springs.

GRAND RIVER NEAR CISCO, UTAH.

Location.—About sec. 7, T. 23 S., R. 24 E., at Dewey ferry, three-quarters of a mile below mouth of Dolores River, 90 miles above junction of Green and Grand rivers, and 14 miles southeast of Cisco, Grand County.

Drainage area.—23,800 square miles.

Records available.—November 10, 1914, to September 30, 1916, at present site; 25 miles downstream at Moab, October 1, 1913, to November 10, 1914; flow about the same at both places.

Gage.—Stevens continuous water-stage recorder on left bank 500 feet above ferry cable.

Discharge measurements.—Made from car on ferry cable and from highway bridge half a mile below gage.

Channel and control.—Channel straight for several hundred feet above and below station. Left bank high and not subject to overflow; right bank fairly high and will probably not be overflowed. Bed at the gage composed of sand and gravel. Control probably about a quarter of a mile below the gage; somewhat shifting.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 13.9 feet at 7 p. m. May 11 (discharge 47,800 second-feet); minimum stage probably occurred in December when clock was stopped.

1915–1916: Maximum stage recorded 13.9 feet at 7 p. m. May 11, 1916 (discharge 47,800 second-feet); minimum stage 1.55 feet September 10, 1915 (discharge 1,460 second-feet).

Ice.—Stage-discharge relation seriously affected by ice. Winter estimates based on current-meter measurements and observer's notes.

Diversions.—Below practically all diversions. A large amount of water is diverted in Colorado for irrigation.

Regulation.—Station is too far below to be affected, except in a general way, by regulation in Colorado.

Accuracy.—Stage-discharge relation permanent; affected by ice December 21 to February 21. Rating curve well defined for range in stage during year. Operation of water-stage recorder satisfactory except during winter when ice formed in well. Daily discharge ascertained by applying to rating table daily gage height taken from graph by inspection except for period when stage-discharge relation was affected by ice. Records obtained by use of rating table good; others fair.

Discharge measurements of Grand River near Cisco, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	L. W. Jordan	2.24	2,560	Feb. 27	A. B. Purton	2.52	3,220
Jan. 6[a]	Lynn Crandall	2.91	2,950	May 14	W. E. Dickinson	12.31	39,600
27[b]	.....do	4.95	3,190	June 23	.....do	10.68	33,500

[a] Ice along shore at riffle for a width of 40 feet; also between gage and riffle.
[b] 60 to 80 feet of ice along each bank at gage and control; floating slush ice.

Daily discharge, in second-feet, of Grand River near Cisco, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,340	2,470	2,380			3,440	7,690	28,200	30,900	23,700	12,500	4,640
2	3,340	2,380	2,470			3,140	7,130	22,400	32,700	22,400	13,100	4,760
3	3,340	2,470	2,560			2,940	6,860	19,000	33,200	21,600	13,800	4,580
4	3,340	2,380	2,750			2,750	7,690	17,300	33,200	20,300	17,300	4,310
5	3,140	2,380	2,660			3,440	8,270	17,300	34,600	18,600	14,200	4,090
6	3,140	2,380	2,750	2,950		4,870	7,980	19,800	35,000	17,300	14,200	4,200
7	3,140	2,560	2,840			4,310	7,410	25,500	34,100	16,500	13,800	4,090
8	3,040	3,340	2,940			3,870	6,860	32,700	33,200	15,300	14,200	4,090
9	2,940	2,840	2,840			3,550	6,210	37,400	31,400	15,300	13,800	4,200
10	2,750	3,550	2,750			3,550	6,080	42,600	33,200	15,700	12,100	5,830
11	2,660	3,440	2,660			3,870	7,130	46,900	36,400	16,900	11,400	6,080
12	2,560	3,040	2,660			4,200	9,180	46,900	39,300	16,100	10,800	6,600
13	2,660	2,750	2,560			4,870	9,500	44,000	40,200	14,900	13,800	6,600
14	2,470	2,470	2,560			5,580	10,100	40,200	41,200	13,500	14,900	6,470
15	2,380	2,380	2,660			6,340	10,500	36,000	41,600	12,800	13,800	6,340
16	2,660	2,380	2,750			6,080	10,100	30,900	40,200	12,500	13,100	5,960
17	2,560	2,290	2,750			5,830	11,400	24,200	39,300	12,100	12,100	5,580
18	2,660	2,560	2,630			6,340	13,500	20,300	39,800	12,500	10,100	5,220
19	2,560	2,660	2,500			7,130	15,300	19,000	39,300	11,800	9,180	4,870
20	2,750	2,750	2,380			7,980	14,900	18,600	39,700	11,100	8,270	4,640
21	2,940	2,840				9,500	13,100	22,000	38,800	10,500	7,690	4,580
22	2,750	2,940				12,800	12,100	22,400	35,500	9,500	7,410	4,310
23	2,750	3,040				16,100	13,500	22,400	32,700	9,180	6,860	4,200
24	2,660	3,240				16,100	16,100	22,000	29,100	8,570	6,080	4,090
25	2,660	3,240				12,100	18,200	21,100	26,400	8,270	5,830	3,980
26	2,470	3,140				10,100	20,300	22,000	25,500	8,270	5,460	4,090
27	2,660	3,040		3,190	3,340	8,870	22,000	22,800	25,000	8,870	5,340	4,090
28	2,660	2,750			3,660	7,980	23,700	23,700	24,600	11,100	5,100	4,090
29	2,560	2,750			3,660	8,270	26,800	24,600	24,600	12,100	4,870	3,980
30	2,470	2,660				8,870	30,900	25,900	24,200	11,800	4,870	3,760
31	2,470					8,270		28,200		11,400	4,760	

NOTE.—Discharge estimated because of ice or lack of gage record, from observer's notes and 2 discharge measurements, as follows: Dec. 21-31, 2,300 second-feet, Jan. 1-5, 2,600 second-feet, Jan. 7-26, 3,000 second-feet, Jan. 26-31, 3,100 second-feet, and Feb. 1-26, 3,200 second-feet. Dec. 18 and 19, interpolated.

Monthly discharge of Grand River near Cisco, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,340	2,380	2,790	172,000
November	3,550	2,290	2,770	165,000
December	2,940		2,580	156,000
January			2,950	181,000
February			3,240	186,000
March	16,100	2,750	6,870	422,000
April	30,900	6,080	12,700	756,000
May	46,900	17,300	27,300	1,680,000
June	41,600	24,200	33,800	2,010,000
July	23,700	8,270	13,900	855,000
August	17,300	4,760	10,300	633,000
September	6,600	3,760	4,810	286,000
The year	46,900		10,300	7,500,000

FRASER RIVER NEAR ARROW, COLO.

Location.—In sec. 4, T. 2 S., R. 75 W., one-fourth mile from Vasquez siding on Denver & Salt Lake Railroad in Arapaho National Forest, and 1¾ miles southwest of Arrow in Grand County. Nearest tributary enters about half a mile above.

Drainage area.—37 square miles for present location of station (measured on special map); 28 square miles for site 1 mile upstream used to June 3, 1916.

Records available.—September 23, 1910, to September 30, 1916.

Gage.—Friez water-stage recorder on left bank about 1 mile below bridge on road to Arrow. Prior to June 3, 1916, vertical staff attached to downstream side of bridge.

Discharge measurements.—Made from footlog bridge or by wading.

Channel and control.—Bed composed of boulders and coarse gravel; practically permanent. Control not well defined. Banks not subject to overflow.

Extremes of discharge.—Maximum discharge during year, from hydrographic comparison of North Fork Grand River near Grand Lake, 260 second-feet on May 10; minimum discharge, 6.8 second-feet, several days in March.

Ice.—Stage-discharge relation not seriously affected by ice except for short period early in winter. Ice forms complete cover and water flows freely beneath it.

Diversions.—There is court decree for diversion of 53 second-feet across divide from headwaters of Fraser River into headwaters of Clear Creek. During 1916, approximately 832 acre-feet were diverted under this decree. Below station there are court decrees for 74 second-feet for irrigation and 61 second-feet for placer and power.

Regulation.—None.

Accuracy.—Stage-discharge relation at upper station not permanent; at lower station practically permanent; affected by ice for short period. Rating curve for upper station poorly defined; for lower station well defined. Staff gage read to hundredths twice daily; operation of water-stage recorder satisfactory after June 10. Daily discharge ascertained by applying to rating table, daily gage height determined either by inspecting gage-height graph or from mean of two readings on staff gage. Records excellent after June; fair prior to that date.

Discharge measurements of Fraser River near Arrow, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	W. R. King	[a]0.89	14.6	June 3	W. R. King	1.14	121
Jan. 29	T. J. Watkins	[a].75	9.4	24	H. K. Smith	1.12	142
Mar. 1	W. R. King	[a].70	6.6	Aug. 14	Follansbee and Hodges	.68	41.2
May 13	do	[b]1.08	132	Sept. 29	Hodges and Keep	.46	19.7
13	do	.98	94	30	P. V. Hodges	.44	18.7

[a] Read on old gage, 1 mile upstream. [b] Old gage read 1.31 feet.

Daily discharge, in second-feet, of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	16	16	14	12	9.5	8.5	8.5	74	202	109	54	27
2	16	16	14	12	9.0	7.1	7.7	74	230	106	51	25
3	16	16	14	12	9.0	9.5	8.0	76	127	102	54	24
4	16	16	13	12	9.0	10.5	8.0	76	145	98	56	23
5	20	14	13	12	9.0	7.1	7.7	76	210	93	54	22
6	16	13	13	11	9.5	7.7	7.7	100	185	85	54	24
7	16	13	13	11	9.5	8.0	8.0	140	160	84	49	21
8	16	15	13	10	10	7.1	7.7	150	135	85	48	20
9	16	14	13	10	10	6.8	9.5	210	150	85	46	19
10	16	15	13	10	10	6.8	9.5	260	168	78	45	23
11	16	16	12	10	10	7.1	10.5	184	165	73	43	26
12	16	16	12	10	10	6.8	10.0	108	163	64	45	28
13	16	16	12	10	10	7.1	11	102	176	60	44	30
14	16	18	12	10	10	6.8	12	98	172	56	43	27
15	16	18	12	10	10	9.5	13	94	168	54	42	25
16	16	20	12	10	10	6.8	14	93	168	56	43	24
17	16	20	12	10	10	6.8	14	90	163	57	43	23
18	16	20	12	11	9.0	7.1	13	100	168	54	41	23
19	16	16	12	11	9.0	7.1	14	110	170	49	38	23
20	16	16	12	11	9.0	6.8	13	130	168	48	38	22
21	16	15	12	12	9.0	6.8	14	130	159	46	37	22
22	16	15	12	12	9.5	7.1	14	130	151	46	34	22
23	16	14	12	12	9.0	6.8	20	152	137	45	33	22
24	16	15	12	12	10	6.8	27	130	133	45	33	22
25	16	13	12	12	10	7.1	37	110	127	43	33	20
26	16	13	12	12	10	7.1	42	130	125	46	32	19
27	16	14	12	9	11	7.4	50	152	125	46	31	19
28	16	14	12	10	11	7.4	69	160	125	49	27	20
29	16	13	12	10	10	9.5	74	176	117	51	26	20
30	16	14	12	10	......	9.5	69	202	111	52	32	20
31	16	......	12	10	......	9.0	......	202	......	57	31	......

NOTE.—Discharge Nov. 12–17 estimated because of ice. Interpolated Dec. 20–24, 26, Jan. 1–2, Feb. 1, 3–4, 7–8, 10–11, 14–15, Apr. 13–16, and Aug. 13; estimated from hydrograph comparison of North Fork of Grand River near Grand Lake May 6–11, 14–18, 21, 25–26, 28, and June 4–9.

Monthly discharge of Fraser River near Arrow, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	20	16	16.1	990
November	20	13	15.5	922
December	14	12	12.4	762
January	12	9	10.8	664
February	11	9	9.69	557
March	10.5	6.8	7.59	467
April	74	7.7	20.8	1,240
May	260	74	130	7,990
June	230	111	157	9,340
July	109	43	65.2	4,010
August	56	26	41.3	2,540
September	30	19	22.8	1,360
The year	260	6.8	42.5	30,800

WILLIAMS FORK NEAR SCHOLL, COLO.

Location.—In sec. 3, T. 2 S., R. 78 W., at Horseshoe ranger station in Arapaho National Forest, about 5 miles southeast of Scholl in Grand County. Nearest large tributary, Keyser Creek, enters from east three-quarters of a mile above station.

Drainage area.—141 square miles (measured on map in Forest atlas).

Records available.—September 22, 1910, to June 30, 1912; April 27, 1913, to September 30, 1916.

Gage.—Vertical staff in pool near right bank 100 feet below bridge; read by forest ranger.

Discharge measurements.—Made by wading or from cable 400 feet above gage.

Channel and control.—Bed composed of boulders; rough. Control 25 feet below gage; will shift slightly. Banks not subject to overflow except during extremely high water.

Extremes of discharge.—Maximum stage recorded during year, 3.15 feet at 5 p. m. June 18, 19, 20 (discharge, 836 second-feet); minimum discharge probably occurred during the winter.

Ice.—Stage-discharge relation somewhat affected by ice; data insufficient for determinations of daily discharge November 11 to February 29.

Diversions.—There are court decrees for the diversion of 858 second-feet from Williams Fork above the station. Of this amount 700 second-feet is to be diverted to the eastern slope, but this diversion has not been made.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during 1916; shifts occasionally between narrow limits. Rating curve well-defined between 30 and 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Owing to high altitude of drainage basin (7,900 feet) there may be considerable diurnal fluctuation at certain seasons of year due to alternate melting and freezing of snow, and mean daily gage height may be somewhat in error. Records good except those for May which are fair.

Discharge measurements of Williams Fork near Scholl, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 5	1.08	37.5
June 5	2.70	548

Daily discharge, in second-feet, of Williams Fork near Scholl, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	83	52	40	48	136	440	469	266	122
2	85	49	39	48	139	498	469	246	116
3	85	48	40	45	146	498	469	246	111
4	83	48	44	48	152	498	440	246	109
5	82	49	43	48	152	498	412	246	109
6	82	46	43	42	180	528	412	246	105
7	77	48	44	54	200	528	412	239	105
8	75	49	44	54	240	528	384	239	103
9	75	49	45	50	310	528	384	235	103
10	72	50	44	60	400	528	384	224	101
11	70	....	45	70	370	528	384	224	99
12	69	....	45	72	340	528	384	190	99
13	69	....	45	74	300	528	384	190	98
14	69	....	46	72	220	588	384	190	96
15	69	....	47	71	200	618	384	190	94
16	69	....	48	69	200	678	266	187	92
17	69	....	49	72	260	709	266	184	90
18	69	....	50	80	270	740	266	180	87
19	69	....	49	86	180	772	266	160	85
20	69	....	50	71	180	804	266	155	80
21	69	....	49	71	180	678	266	149	77
22	69	....	50	82	185	709	266	146	77
23	69	....	50	82	190	678	266	136	77
24	66	....	50	92	200	678	266	136	77
25	66	....	49	94	210	678	266	132	75
26	61	....	49	99	230	618	266	132	74
27	56	....	50	103	266	588	266	129	74
28	59	....	50	103	384	588	266	126	74
29	55	....	50	118	384	588	266	124	72
30	54	....	50	136	384	528	266	122	72
31	54	....	49	....	412	....	266	120	....

NOTE.—Data insufficient to determine daily discharge, Nov. 11 to Feb. 29, because of ice. Discharge estimated Oct. 11, Apr. 8–19, July 23–27, and Sept. 15–16. Discharge estimated May 7–26 from hydrographic comparison with record of flow of Williams Fork near Parshall, because gage heights were apparently in error.

Monthly discharge of Williams Fork near Scholl, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	85	54	69.9	4,300
November 1–10	52	46	48.8	968
March	50	39	46.6	2,870
April	136	42	73.8	4,390
May	412	136	245	15,100
June	804	440	597	35,500
July	469	266	336	20,700
August	266	120	185	11,400
September	122	72	91.8	5,460

WILLIAMS FORK NEAR PARSHALL,[1] COLO.

Location.—About sec. 36, T. 1 N., R. 79 W., at highway bridge at Field's ranch, 4 miles above the mouth of the river and 4 miles south of Parshall, in Grand County. Nearest tributary, Battle Creek, enters from the west 2 miles below station.

Drainage area.—185 square miles (measured on map in Forest atlas).

Records available.—July 25, 1904, to September 30, 1916.

Gage.—Vertical staff on downstream side of bridge pier; read by F. A. Field.

Discharge measurements.—Made from bridge or by wading nearby.

Channel and control.—Bed composed of coarse gravel and small boulders; shifts. Control is gravel bar 50 feet downstream; shifts during high water. At stage of 4.1 feet water begins to flow through small overflow channel.

Extremes of discharge.—Maximum stage recorded during year, 4.68 feet at 8.40 a. m. June 19 (discharge, 1,030 second-feet); minimum discharge, 30 second-feet November 30, December 12, 20, 27, January 8 and 31, when stage-discharge relation was affected by ice.

Ice.—The main channel is kept open by springs, but ice forms along the banks, and slush ice also frequently forms. Morning readings are usually affected by backwater from ice, but afternoon readings are sometimes unaffected.

Diversions.—There are court decrees for the diversion of 558 second-feet from Williams Fork between the station near Scholl and that near Parshall. There are also two storage decrees for 80,700 acre-feet and 1,420 acre-feet, respectively, from Williams Fork.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts occasionally between narrow limits; affected by ice for short periods during winter. Rating curve well defined between 40 and 1,500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for winter, which are fair.

Discharge measurements of Williams Fork near Parshall, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	W. R. King............	3.03	82	May 16	W. R. King............	3.56	210
Feb. 3	T. J. Watkins..........	2.78	46.9	June 5	.....do..................	4.12	522
Mar. 4	W. R. King............	2.86	49.9	27	H. K. Smith...........	4.26	631

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[1] Described in earlier reports as Williams Fork near Sulphur Springs, Colo.

Daily discharge, in second-feet, of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	96	70	40	40	32	47	74	172	475	590	195	111
2	100	69	35	42	33	46	71	169	475	550	169	96
3	89	73	50	36	34	50	71	134	475	510	169	114
4	93	76	56	44	34	54	66	140	475	510	275	114
5	93	77	52	42	31	54	73	151	550	475	300	103
6	91	71	52	36	42	49	58	182	475	440	210	116
7	76	77	45	33	42	56	68	280	440	408	225	105
8	73	74	40	30	40	50	68	370	475	375	203	96
9	77	68	38	38	43	50	61	408	510	375	195	96
10	74	74	35	34	43	53	71	510	630	353	206	116
11	73	89	32	33	40	57	80	440	630	315	166	122
12	76	56	30	32	42	61	84	440	710	310	178	114
13	78	69	37	31	40	53	86	408	795	285	192	129
14	83	50	46	40	40	62	83	300	750	266	199	134
15	86	59	50	48	40	73	82	252	750	261	172	120
16	77	57	56	34	48	71	80	225	750	248	162	114
17	86	56	50	40	50	73	83	342	750	234	159	96
18	80	80	44	44	46	68	98	252	795	225	142	96
19	77	86	37	44	40	68	105	206	940	206	132	96
20	76	84	30	40	48	69	83	230	840	195	118	96
21	80	64	52	36	47	74	83	218	840	178	122	94
22	76	50	52	34	42	89	89	243	795	162	120	94
23	76	61	50	32	40	68	118	218	710	151	109	96
24	76	59	50	32	40	68	129	243	710	132	105	107
25	74	89	61	40	42	77	151	336	630	132	103	98
26	73	68	40	42	48	59	162	364	630	140	114	94
27	69	57	30	41	52	74	192	336	630	134	118	91
28	71	40	40	39	49	71	225	331	630	162	111	91
29	68	35	50	36	48	76	252	358	630	159	98	93
30	64	30	61	33	....	66	199	358	670	182	122	91
31	64	....	48	30	....	80	....	440	....	203	127	....

NOTE.—Discharge estimated because of ice for following periods: Nov. 29–30, Dec. 1–2, 8–13, 17–20, 24, 27–28, Jan. 7–8, 11–13, 17, 20–23, 27–31, Feb. 1–2, 29, and Mar. 1–3. Shifting-control method used July 20 to Sept. 30.

Monthly discharge of Williams Fork near Parshall, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	100	64	78.9	4,850
November	89	30	65.6	3,900
December	61	30	44.8	2,750
January	48	30	37.3	2,290
February	52	31	41.9	2,410
March	89	46	63.4	3,900
April	252	58	105	6,250
May	510	134	292	18,000
June	940	440	652	38,800
July	590	132	286	17,600
August	300	98	162	9,960
September	134	91	104	6,190
The year	940	30	161	117,000

BLUE RIVER AT DILLON, COLO.

Location.—In sec. 18, T. 5 S., R. 77 W., at cemetery bridge on outskirts of Dillon, in Summit County, on edge of Leadville National Forest. Nearest tributaries, Snake River, which enters a short distance below station, and Tenmile Creek, which also enters below.

Drainage area.—110 square miles (measured on map in Forest atlas).

Records available.—October 15, 1910, to September 30, 1916.

Gage.—Vertical staff on right abutment of bridge facing channel; read by J. H. Woodward.

Discharge measurements.—Made from bridge, or by wading.

Channel and control.—Bed composed of compact gravel upon which lodge tailing slimes from hydraulic dredges near Breckenridge. Control is riffle 50 feet downstream from gage; permanent. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.19 feet at 6 a. m. June 20 (discharge, 520 second-feet); minimum stage, 1.27 feet at 5 p. m. April 8 (discharge, 18 second-feet).

Ice.—Stage-discharge relation seriously affected by ice; discharge estimated by comparison with records of flow for Snake River and Tenmile Creek.

Diversions.—There are court decrees for the diversion of 2.3 second-feet for irrigation from Blue River above the station and 63 second-feet below, exclusive of a decree for 350 second-feet for the Green Mountain canal not yet built. In addition there are placer decrees for diversions of 118 second-feet from the Blue near Breckenridge. There is an unadjudicated diversion from the headwaters of the Blue across Boreas Pass to Tarryall Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation affected by deposition of tailing slimes on control; shifts between narrow limits; affected by ice. Rating curve well defined between 20 and 700 second-feet. Gage read to hundredths twice daily except during winter, when it was read only occasionally. Daily discharge ascertained by applying daily gage height to rating table, except November 14 to March 31, April 2–4, 6, 7, 9–11, 13, 14, and 16, for which it was estimated from hydrographic comparison with records of flow of Snake River and Tenmile Creek at Dillon, and April 1 to September 30, for which shifting-control method was used. Records good except those for November to April, which are fair.

Discharge measurements of Blue River at Dillion, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 15	T. J. Watkins	[a]1.74	28.4
Feb. 12	do	[a]1.75	28.6
July 13	Robert Follansbee	2.47	221

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Blue River at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	78	53	45	33	26	24	23	126	412	368	285	98
2	78	53	45	33	26	24	23	111	412	368	225	86
3	78	53	44	33	27	25	22	92	412	368	191	86
4	78	53	44	32	27	25	22	94	435	325	245	80
5	78	48	43	31	27	25	22	104	480	305	325	78
6	78	48	43	30	27	25	20	161	458	285	245	78
7	70	48	43	30	28	25	20	176	345	245	208	78
8	70	48	42	30	28	24	18	285	325	225	225	78
9	64	48	41	30	29	24	22	345	368	265	208	76
10	70	48	40	30	29	24	26	368	412	265	176	80
11	70	48	39	30	29	24	30	368	480	245	158	98
12	70	48	39	30	29	24	34	345	502	208	161	96
13	70	48	39	29	28	23	34	325	502	225	208	104
14	78	48	39	29	27	23	35	305	502	225	245	94
15	78	48	38	28	27	22	35	285	458	208	225	86
16	78	48	38	28	27	23	36	225	458	208	176	84
17	70	47	37	28	27	23	38	208	435	225	155	81
18	70	47	37	28	27	24	43	191	412	225	143	80
19	64	46	37	28	26	24	46	176	502	208	131	78
20	64	46	37	28	26	24	43	191	480	176	118	78
21	64	46	36	28	25	24	45	191	435	161	137	72
22	64	46	36	28	25	24	48	208	412	161	126	72
23	64	46	35	28	24	24	55	176	285	161	121	72
24	64	45	35	28	24	24	75	176	325	155	116	69
25	64	45	34	28	23	24	88	285	325	152	116	68
26	64	46	34	27	23	24	116	265	325	161	108	68
27	64	46	34	27	23	24	140	245	305	208	111	68
28	64	46	33	27	23	24	158	285	325	191	98	65
29	64	46	33	27	24	23	191	305	368	176	94	65
30	53	46	33	27	......	24	158	325	368	285	108	64
31	53	......	33	26	......	23	......	368	......	265	98	......

Monthly discharge of Blue River at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	78	53	68.9	4,240
November	53	45	47.7	2,840
December	45	33	38.3	2,360
January	33	26	29.0	1,780
February	29	23	26.2	1,510
March	25	22	23.9	1,470
April	191	18	55.5	3,300
May	368	92	236	14,500
June	502	305	409	24,300
July	368	152	234	14,400
August	325	94	171	10,500
September	104	64	79.3	4,720
The year	502	18	118	85,900

SNAKE RIVER AT DILLON, COLO.

Location.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 200 yards above mouth of river at Dillon, in Summit County. Nearest tributary, a small stream from the north, enters 1 mile above station.

Drainage area.—92 square miles (measured on map in Forest atlas).

Records available.—October 15, 1910, to September 30, 1916.

Gage.—Vertical staff on downstream side of right bridge abutment; read by J. H. Woodward. Prior to April 26, 1913, gage was 2 feet farther upstream, and although referred to same datum water piled up on gage during high water, giving a higher reading for same discharge.

Discharge measurements.—Made from bridge, or by wading just below gage.

Channel and control.—Bed composed of small boulders; rough but permanent. Control 50 feet downstream will shift slightly at long intervals. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 2.2 feet at 5.30 p. m. June 14, and 6 p. m. June 16 (discharge, 430 second-feet); minimum flow occurred during winter when discharge was estimated by comparison with records of flow of Blue River and Tenmile Creek.

Ice.—Stage-discharge relation seriously affected by ice; flow estimated from discharge measurements, observers notes, and weather records.

Diversions.—The Summit County Power Co. diverts about 30 second-feet from Snake River above Dillon. Water is usually diverted from April to November. There is also an irrigation decree for 4.5 second-feet above Dillon.

Regulation.—See diversions.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined below 600 second-feet. Gage read to hundredths twice daily except during winter, when it is read only occasionally. Daily discharge ascertained by applying daily gage height to rating table, except November 14 to April 16, for which it was estimated by comparison with records of flow of Blue River and Tenmile Creek, based on occasional gage heights. Records good except November to April, for which they are fair.

Discharge measurements of Snake River at Dillon, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 15	T. J. Watkins	0.55	11.0
Feb. 12	....do	.60	13.1
July 14	Robert Follansbee	1.52	145

Daily discharge, in second-feet, of Snake River at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	14	12	11	10	11	12	47	249	262	136	49
2	15	13	12	11	10	11	12	44	240	244	128	41
3	14	13	12	11	10	11	12	37	254	236	116	41
4	14	13	12	11	11	11	12	45	280	228	121	33
5	14	13	12	11	11	11	11	45	285	216	131	38
6	14	13	12	10	11	11	11	74	249	193	126	40
7	13	13	12	10	11	11	11	94	196	168	111	31
8	13	13	12	10	11	11	11	126	216	168	121	28
9	14	13	....	10	11	11	12	165	280	220	128	27
10	14	12	....	10	11	11	13	212	330	204	105	33
11	14	12	....	11	12	11	14	182	380	182	92	42
12	14	12	....	11	13	11	16	190	380	176	92	42
13	13	12	....	11	12	10	16	190	405	142	103	45
14	13	....	....	11	12	10	16	159	405	136	103	38
15	13			11	11	10	15	136	405	131	103	33
16	13	....	....	10	11	10	16	105	430	128	96	29
17	14	....	....	10	11	11	18	94	405	139	88	26
18	14	....	....	10	11	11	20	92	355	136	79	25
19	14	....	....	10	11	11	19	90	380	142	76	24
20	13	....	....	10	11	11	25	100	380	107	70	22
21	13	....	....	10	11	11	19	107	355	100	68	21
22	13	....	....	10	12	11	22	105	355	100	60	20
23	13	....	....	10	12	11	25	92	276	100	60	19
24	13	....	....	10	12	11	28	98	285	105	56	23
25	13	....	....	10	12	11	36	111	308	92	57	22
26	13	....	....	10	12	11	57	139	262	85	55	18
27	13	....	....	10	12	11	60	131	267	153	53	16
28	13	....	....	10	12	11	72	142	285	172	47	16
29	14	....	....	10	12	11	70	168	308	124	46	17
30	14	....	....	10	....	11	58	190	280	258	58	14
31	14	....	....	10	....	11	....	200	....	165	53	....

NOTE.—Water diverted by the Snake River ditch not included in above table. Discharge, Oct. 1 and 2 estimated. Gage not read Nov. 14–30 and Dec. 9–31; discharge for each period estimated at 12 second-feet. Gage read twice weekly Jan. 1 to Apr. 16; discharge interpolated for days on which gage was not read.

Monthly discharge of Snake River at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	15	13	13.6	836
November	14	....	12.3	732
December	....	....	12.0	738
January	11	10	10.3	633
February	12	10	11.3	650
March	11	10	10.9	670
April	72	11	24.6	1,460
May	212	37	120	7,380
June	430	196	316	18,800
July	262	85	162	9,960
August	136	46	88.3	5,430
September	49	14	29.1	1,730
The year	430	....	67.5	49,000

NOTE.—Water diverted by Snake River ditch not included in the above table.

Daily discharge, in second-feet, of Snake River ditch near Dillon, Colo., for the period Aug. 1 to Sept. 30, 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	37	37	11	31	37	21	37	37
2	37	31	12	31	44	22	31	37
3	37	31	13	37	44	23	31	37
4	37	37	14	44	44	24	31	37
5	37	37	15	44	44	25	31	37
6	37	37	16	44	37	26	31	37
7	44	37	17	37	37	27	31	37
8	44	37	18	37	37	28	31	37
9	37	37	19	37	37	29	37	31
10	37	37	20	37	37	30	37	31
						31	37	....

NOTE.—No records before Aug. 1, although ditch was carrying some water. Mean monthly discharge for August was 36.4 second-feet (2,240 acre-feet); for September, 37.1 second-feet (2,210 acre-feet).

TENMILE CREEK AT DILLON, COLO.

LOCATION.—In sec. 18, T. 5 S., R. 77 W., at highway bridge 300 yards above mouth of creek, in Dillon, Summit County. Nearest tributary, Canyon Creek, enters from the west about 4 miles above.

DRAINAGE AREA.—113 square miles (measured on map in Forest Atlas).

RECORDS AVAILABLE.—October 15, 1910, to September 30, 1916.

GAGE.—Vertical staff on downstream of center pier of bridge; read by J. H. Woodward. Prior to June 10, 1914, gage was at side of pier and at same datum as present gage. During high stages the water piled up on the gage so that readings were higher than those obtained from gage in present position.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading near gage.

CHANNEL AND CONTROL.—Bed composed of small boulders; rough but permanent. Control 50 feet downstream from gage; permanent. Banks high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.51 feet at 5 p. m. June 12 (discharge, 902 second-feet); minimum discharge, 23 second-feet January 2 to February 1 (estimated because of ice).

ICE.—Stage-discharge relation seriously affected by ice; daily discharge estimated by comparison with records of flow of Snake and Blue rivers.

DIVERSIONS.—There are court decrees for the diversion of 11 second-feet from Tenmile Creek above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent except as affected by ice December 1 to March 21. Rating curve well defined between 20 and 900 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table or (Nov. 14 to Apr. 16) by comparison with records of flow of Snake and Blue Rivers. Records good except those for November to April, which are fair.

Discharge measurements of Tenmile Creek at Dillon, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*
Jan. 15	T. J. Watkins	[a]1.67	24.0
Feb. 12	.....do	[a]1.70	28.9
July 13	Robert Follansbee	2.49	213

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	40	36	25	23	24	31	137	715	540	170	64
2	52	40	36	25	24	24	31	125	680	470	167	55
3	52	40	36	25	24	24	31	110	680	400	159	55
4	52	40	35	25	24	24	31	108	750	376	174	54
5	46	38	35	25	24	24	31	119	645	352	192	54
6	46	36	35	25	25	24	31	178	540	322	159	61
7	46	36	35	25	25	24	30	202	505	280	151	55
8	42	36	34	25	26	24	30	435	575	247	151	50
9	40	36	34	25	27	24	33	540	715	292	167	52
10	40	36	33	25	28	24	36	575	820	292	134	67
11	40	36	33	25	28	24	39	575	820	304	122	75
12	40	36	32	24	29	24	41	575	858	247	148	66
13	40	36	32	24	28	24	41	540	820	230	148	82
14	46	36	31	24	28	24	40	376	820	216	163	80
15	46	36	31	24	27	24	40	334	820	202	131	69
16	46	36	31	24	26	25	44	264	858	206	113	62
17	40	35	31	24	26	25	48	220	785	216	110	58
18	40	35	30	24	25	26	51	206	715	216	96	55
19	36	35	30	24	25	26	52	202	750	197	91	55
20	36	36	29	24	24	26	50	211	715	174	86	54
21	36	36	28	24	24	27	48	211	680	151	86	50
22	36	36	28	23	24	28	55	183	610	151	80	48
23	36	36	28	23	24	28	60	192	540	151	78	45
24	36	36	28	23	24	28	62	220	505	159	75	48
25	36	36	27	23	24	28	84	292	540	131	75	47
26	40	36	27	23	24	28	119	394	470	131	73	45
27	40	36	26	23	24	28	148	352	470	151	67	44
28	40	36	26	23	24	29	197	376	505	148	64	44
29	40	36	26	23	24	29	225	505	505	148	61	44
30	40	36	26	23	....	30	181	645	435	274	69	42
31	40	....	26	23	....	30	....	680	....	211	66	....

Monthly discharge of Tenmile Creek at Dillon, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	52	36	41.9	2,580
November	40	35	36.5	2,170
December	36	26	30.8	1,890
January	25	23	24.0	1,480
February	29	23	25.2	1,450
March	30	24	25.8	1,590
April	225	30	64.7	3,850
May	680	108	325	20,000
June	858	435	662	39,400
July	540	131	245	15,100
August	192	61	117	7,190
September	82	42	56.0	3,330
The year	858	23	138	100,000

EAGLE RIVER AT REDCLIFF, COLO.

Location.—In sec. 29, T. 6 S., R. 80 W., at footbridge in town of Redcliff, Eagle County. Nearest tributary, Turkey Creek, enters 100 yards below station; Homestake Creek enters 1 mile below.

Drainage area.—74 square miles (measured on topographic map).

Records available.—January 8, 1911, to September 30, 1916.

Gage.—Chain on downstream side of footbridge; read by forest ranger.

Discharge measurements.—Made from highway bridge 800 feet above station, or by wading.

Channel and control.—Bed composed of boulders; very rough. Control, short distance below gage, will shift at long intervals. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.18 feet at 6.30 a. m., May 10 (discharge, 582 second-feet); minimum stage, 0.33 foot at 8 a. m., November 24 (discharge, 5 second-feet).

Ice.—Stage-discharge relation not affected by ice except occasionally for short periods.

Diversions.—There are court decrees for the diversion of 6 second-feet from Eagle River above station, and also a decree for diversion to the Arkansas basin of 18.5 second-feet from Piney Creek, a tributary. From January 1 to September 30 2,260 acre-feet were diverted.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts between narrow limits; affected by ice November 16–18, and January 27 to February 3. Rating curve well defined below 500 second-feet. Gage read to hundredths twice daily except when forest ranger was away (see footnote to daily-discharge table). Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Eagle River at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	W. R. King	0.76	14.6	Feb. 13	T. J. Watkins	0.48	14.7
Jan. 14	T J. Watkins	.68	14.8	June 9	W. R. King	2.43	304

Daily discharge, in second-feet, of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	21	13	13	11	12	17	27	170	410	127	64	25
2	20	12	14	11	14	21	35	147	370	121	53	25
3	20	12	14	12	17	20	36	147	430	118	51	24
4	21	12	13	12	20	22	36	170	410	115	51	24
5	20	12	13	13	18	19	35	147	470	112	50	24
6	19	13	13	14	22	22	33	147	385	109	48	26
7	19	13	14	12	16	20	32	184	300	106	46	24
8	19	13	14	13	19	18	32	220	265	92	44	29
9	17	14	13	11	17	19	30	510	390	93	40	22
10	16	16	14	14	16	22	38	550	350	94	38	30
11	16	12	12	14	18	15	51	450	330	95	36	38
12	16	13	15	13	20	18	57	430	315	109	35	30
13	17	12	13	13	12	20	62	470	350	84	35	32
14	18	12	13	13	17	20	62	368	350	80	36	33
15	18	12	14	14	18	20	64	265	280	78	36	28
16	20	12	13	13	20	22	62	182	280	76	38	30
17	20	11	12	14	29	24	69	178	270	74	37	28
18	20	10	12	16	25	28	89	175	260	72	36	27
19	20	10	13	16	22	33	92	172	250	67	32	24
20	20	10	14	14	20	35	65	168	220	62	32	24
21	20	10	14	15	17	39	73	165	220	52	32	27
22	17	10	13	14	21	33	89	161	195	51	32	23
23	17	8	13	15	37	36	104	158	182	47	30	23
24	17	5	13	16	25	35	83	147	174	44	30	23
25	17	8	12	15	22	28	170	170	165	43	29	23
26	16	11	12	14	18	28	208	250	156	48	28	23
27	16	12	12	13	21	29	170	220	147	55	27	23
28	16	12	12	12	24	35	170	235	147	57	26	23
29	15	13	12	11	13	35	170	250	137	59	24	23
30	15	15	15	10	......	35	195	291	137	60	28	22
31	14	......	12	10	......	25	......	332	......	62	27	......

Note.—Discharge Nov. 16–18, and Jan. 27 to Feb. 3, estimated because of ice. Gage not read, discharge estimated for following periods: Oct. 3, 10, 20, 24, Nov. 5, 7, 14, 19–23, 25, 28, Dec. 19, 24–26, Jan. 2–3, 12, 17, 26, Feb. 11, 18–20, 25, Mar. 1, 12, 26, May 7, 14, 17–22, 28, 30, June 6–7, 11, 17–18, 24–26, July 2–6, 9–10, 15–16, 23, 28–30, Aug. 5–7, 10–11, 13–14, 17, 20–21, 24, 26–27, Sept. 3, 10, 13, 17, 23–27.

Monthly discharge of Eagle River at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	21	14	18.0	1,110
November	16	5	11.6	690
December	15	12	13.1	806
January	16	10	13.2	812
February	37	12	19.7	1,170
March	39	15	25.6	1,570
April	208	27	81.3	4,840
May	550	147	246	15,100
June	470	137	278	16,500
July	127	43	79.4	4,880
August	64	24	37.1	2,280
September	38	22	26.0	1,550
The year	550	5	70.7	51,300

EAGLE RIVER AT EAGLE, COLO.

Location.—In sec. 33, T. 4 S., R. 84 W., at highway bridge at Eagle, in Eagle County. Nearest tributary, Brush Creek, enters three-fourths mile below station.

Drainage area.—630 square miles (measured on map in Forest atlas).

Records available.—January 17, 1911, to September 30, 1916. March 12, 1905, to February 10, 1907, station was maintained short distance below mouth of Brush Creek.

Gage.—Chain on downstream side of bridge; read by D. L. Wedmore. Prior to August, 1915, vertical staff fastened to right abutment was used. This gage was referred to same datum as present gage and Weather Bureau gage near by.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed composed of boulders; very rough. Control not well defined. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 4.21 feet at 8 a. m. June 20 (discharge, 3,770 second-feet); minimum discharge occurred during winter.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Between Eagle and the station at Redcliff there are court decrees for diversion of 380 second-feet from Eagle River, of which 300 second-feet is for power. Below Eagle there are decrees for 22 second-feet from Eagle River.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve well-defined below 4,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good, except those for spring months, when one daily reading of gage may not give true mean for day because of diurnal fluctuation; spring record fair.

Discharge measurements of Eagle River at Eagle, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 10	0.38	164
Apr. 25	1.54	721
June 8	3.01	2,230

Daily discharge, in second-feet, of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	265	158	....	217	825	2,340	2,660	1,120	400
2	246	158	....	217	825	2,460	2,590	1,120	375
3	246	158	....	221	825	2,460	2,340	1,080	375
4	227	158	....	227	748	2,590	2,220	1,030	350
5	211	147	....	211	785	2,720	1,980	1,030	350
6	211	147	....	211	1,080	2,460	1,860	988	350
7	195	158	....	195	1,510	2,220	1,740	988	328
8	195	147	....	195	2,100	2,220	1,740	945	328
9	170	152	138	195	2,720	2,460	1,620	905	305
10	182	158	147	195	3,110	2,850	1,620	865	285
11	182	158	170	285	2,720	3,110	1,510	785	285
12	195	158	170	350	2,720	3,370	1,510	748	285
13	195	154	170	400	2,460	3,630	1,410	710	285
14	195	155	182	350	2,340	3,500	1,410	675	285
15	195	155	195	350	1,980	3,370	1,310	675	285
16	195	156	195	375	1,980	3,500	1,310	640	285
17	195	156	195	400	1,980	3,500	1,260	640	265
18	195	157	211	428	1,960	3,500	1,210	608	265
19	195	157	211	428	1,860	3,630	1,210	608	265
20	211	158	208	400	1,740	3,760	1,210	575	246
21	211	158	205	400	1,510	3,630	1,160	545	246
22	211	158	205	400	1,260	3,500	1,080	545	227
23	195	147	211	608	1,410	3,240	1,080	515	211
24	195	147	214	640	1,510	3,110	1,080	515	208
25	195	147	214	748	1,510	3,110	1,030	485	201
26	182	147	214	710	1,740	2,850	988	455	201
27	170	147	211	865	1,310	2,720	988	455	195
28	170	147	208	1,030	1,620	2,720	988	455	190
29	158	147	211	1,160	1,740	2,590	1,310	428	188
30	158	147	211	1,120	1,860	2,720	1,210	428	188
31	158	....	214	....	2,220	....	1,210	400	....

NOTE.—Discharge Nov. 15-21 and 30, estimated, because of ice; observations discontinued Dec. 1 to Mar. 8. Discharge Oct. 1-2, Nov. 14, 25, 28, and Apr. 9, estimated.

Monthly discharge of Eagle River at Eagle, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	265	158	197	12,100
November	158	147	153	9,100
March 9-31	214	138	196	8,940
April	1,160	195	451	26,800
May	3,110	748	1,740	107,000
June	3,760	2,220	2,990	178,000
July	2,660	988	1,480	91,000
August	1,120	400	708	43,500
September	400	188	275	16,400

TURKEY CREEK AT REDCLIFF, COLO.

LOCATION.—In sec. 19, T. 6 S., R. 80 W., at highway bridge in Redcliff, Eagle County, 800 feet above mouth of creek.

DRAINAGE AREA.—27 square miles (measured on map in Forest atlas).

RECORDS AVAILABLE.—June 30, 1913, to September 30, 1916.

GAGE.—Vertical staff on downstream side of left bridge abutment; read by Forest ranger.

DISCHARGE MEASUREMENTS.—Made from single span bridge or by wading nearby.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; will shift. Control not well defined. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.2 feet at 7 p. m. June 12 (discharge, 302 second-feet); minimum stage, 0.67 foot at 8 a. m. November 11, and 7.15 a. m. November 12 (discharge, 3.7 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—There is court decree for diversion of 5.5 second-feet from Turkey Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during 1916 until high water in June, when a boulder rolled under gage; not affected by ice. Rating curve fairly well defined below 200 second-feet. Gage read to hundredths twice daily except when forest ranger was away (see footnote to table of daily discharge). Daily discharge ascertained by applying daily gage height to rating table. Records October to June good; July to September fair.

Discharge measurements of Turkey Creek at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9	W. R. King	0.90	7.0	Feb. 13	T. J. Watkins	.78	4.7
Jan. 14	T. J. Watkins	.70	4.1	June 9	W. R. King	2.26	154

Daily discharge, in second-feet, of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	6	4	4	4	4	7	38	182	94	16	11
2	8	6	5	4	4	4	6	29	182	88	16	13
3	8	6	4	4	4	4	7	25	166	82	16	12
4	9	6	4	4	4	4	7	26	182	76	17	11
5	9	6	5	4	4	6	7	26	198	70	16	10
6	8	6	5	4	4	4	6	50	270	64	15	12
7	8	6	4	5	4	4	7	75	240	58	14	11
8	8	7	5	4	4	4	7	100	222	45	13	11
9	8	7	4	4	4	4	7	111	159	36	13	12
10	8	5	4	4	4	5	9	174	238	40	13	13
11	8	4	4	4	4	4	15	152	270	39	13	14
12	8	5	4	4	4	5	11	144	302	34	13	11
13	9	5	4	4	5	7	11	108	238	35	13	12
14	8	5	4	4	5	7	11	130	238	30	13	12
15	9	5	4	4	5	6	12	111	222	27	13	10
16	8	5	4	4	5	6	11	82	222	24	13	10
17	8	4	4	4	5	7	11	78	222	22	13	13
18	8	5	4	4	4	7	14	75	222	23	13	16
19	7	5	4	4	4	4	20	70	222	22	11	10
20	7	5	4	4	4	8	18	64	206	22	11	10
21	7	4	4	4	4	9	15	60	206	18	11	10
22	8	4	4	4	4	8	18	58	190	18	11	10
23	8	4	4	4	4	8	21	52	174	18	10	10
24	8	4	4	4	5	8	27	47	160	18	10	10
25	8	4	4	4	5	7	28	75	148	16	11	10
26	10	4	4	4	5	6	29	93	134	20	11	9
27	9	4	4	4	4	5	38	110	120	24	10	9
28	8	4	4	4	4	7	43	140	114	27	10	9
29	7	4	4	4	4	7	62	129	110	30	11	9
30	7	4	4	4	......	7	36	140	98	24	12	10
31	7	......	4	4	......	7	......	165	......	17	11	......

Note.—Gage not read; discharge estimated: Oct. 3, 10, 20, 24, 27–31, Nov. 1–8, 14, 19–23, 25–26, 28, Dec. 12, 18–19, 23–26, 30, Jan. 2–3, 6, 9, 16, 22, 26–28, Feb. 11–12, 14, 17–21, 25, 29, Mar. 1–3, 12, 26, May 7, 14, 17–22, 28, 30–31, June 6–7, 11, 17–18, 24–26, July 2–6, 9–10, 15–16, 23, 28–30, Aug. 5–7, 10, 12–14, 17, 20–21, 24, 26–27, Sept. 3, 10, 13, 17, 23–27. Shifting-control method used June 27 to Sept. 30.

Monthly discharge of Turkey Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	10	7	8.03	494
November	7	4	4.97	296
December	5	4	4.13	254
January	5	4	4.03	248
February	5	4	4.28	246
March	9	4	5.90	363
April	62	6	17.4	1,040
May	174	25	88.3	5,430
June	302	96	195	11,600
July	94	16	37.5	2,310
August	17	10	12.7	781
September	16	9	11.0	655
The year	302	4	32.7	23,700

HOMESTAKE CREEK AT REDCLIFF, COLO.

Location.—In sec. 30, T. 6 S., R. 80 W., half a mile above mouth of creek at Forest Service bridge, and 1 mile from Redcliff, in Eagle County; below all tributaries.

Drainage area.—64 square miles (measured on topographic map).

Records available.—August 17, 1914, to September 30, 1916. From January 8, 1911, to August 16, 1914, station was located quarter of a mile downstream.

Gage.—Vertical staff on left abutment of bridge facing current; read by forest ranger. Gage used prior to August 17, 1914, was vertical staff attached to large boulder on right bank quarter of a mile downstream and just above the cascades.

Discharge measurements.—Made from bridge or by wading near by.

Channel and control.—Bed composed of gravel well compacted. Control is 50 feet downstream at small rapids; apparently permanent. Several small overflow channels around left bank carry water at stages above 2.3 feet.

Extremes of discharge.—Maximum stage recorded during year, 3.17 feet at 9 a. m., June 13 (discharge, 658 second-feet); minimum discharge probably occurred during winter months.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—There are court decrees for diversion of 1.2 second-feet from a tributary of Homestake Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; seriously affected by ice November 24 to March 31. Rating curve well-defined below 600 second-feet. Gage read to hundredths occasionally. Daily discharge April to September estimated from hydrographic comparison with records of flow of Eagle River and Turkey Creek, based on occasional gage heights. Records only fair owing to possible diurnal fluctuations and infrequent gage readings.

Discharge measurements of Homestake Creek at Redcliff, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 9	W. R. King	0.33	5.6
Jan. 14	T. J. Watkins	[a] .70	9.2
June 9	W. R. King	2.42	397

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Homestake Creek, at Redcliff, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	7	45	129	350	347	118	35
2	33	7	44	112	347	325	116	30
3	30	7	42	102	400	300	114	28
4	27	7	40	110	381	270	110	30
5	24	7	40	118	450	250	100	30
6	19	8	40	134	410	230	90	31
7	15	8	40	170	390	218	85	27
8	14	8	38	300	390	230	80	35
9	14	8	38	432	381	210	75	40
10	13	8	47	520	480	185	70	48
11	13	9	58	398	520	180	68	50
12	13	10	68	364	468	172	66	48
13	13	10	78	347	650	180	70	48
14	13	7	90	240	610	200	80	48
15	15	7	96	205	468	190	93	49
16	20	7	100	200	460	180	80	45
17	18	7	107	195	500	160	70	40
18	16	6	110	192	580	145	63	35
19	16	5	126	190	590	135	58	34
20	16	5	100	188	500	128	55	30
21	16	5	90	186	468	120	57	30
22	16	5	80	186	468	110	54	30
23	16	4	100	188	460	105	50	30
24	15	2	117	190	455	104	48	30
25	18	1	129	194	450	110	48	28
26	11	2	112	205	445	114	48	28
27	10	4	172	210	435	118	45	28
28	9	6	155	205	425	120	42	28
29	8	7	155	230	415	120	40	27
30	8	8	162	285	380	120	40	27
31	8	....	....	381	....	120	39	....

NOTE.—Gage read Oct. 5, 13, 16, 18, 23, 26, 29, Nov. 2, 9, 24, 27, Apr. 9–10, 17, 22, 24–27, May 1, 3, 9–13, 15, 25, 28, 30–31, June 2, 4, 9, 12–15, 19, 21–22, 29, July 1, 6–8, 12, 20, 22, 24, Aug. 3, 12, 15, 18, 21, 23, 31, Sept. 3, 6–7, 15, 20, 25, 29; discharge estimated between readings.

Monthly discharge of Homestake Creek at Redcliff, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	37	8	16.4	1,010
November	10	1	6.4	381
April	172	38	87.3	5,190
May	520	102	229	14,100
June	650	347	458	27,300
July	347	104	177	10,900
August	118	39	70.1	4,310
September	50	27	34.9	2,080

ROARING FORK AT ASPEN, COLO.

LOCATION.—In sec. 7, T. 10 S., R. 84 W., at bridge near old power plant at Aspen, in Pitkin County. Castle, Maroon, and Hunter creeks enter below.

DRAINAGE AREA.—109 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 25, 1915, to September 30, 1916. From January 1, 1911, to February 24, 1915, station was maintained just below Cooper Avenue bridge three-quarters of a mile upstream.

GAGE.—Vertical staff at downstream end of right bridge abutment; read irregularly by forest ranger until May 9; after which read by Chas. Gerstle, jr. Gage used at original section was vertical staff fastened to old crib abutment on right bank, 25 feet below Cooper Avenue bridge: no determined relation between two gages.

DISCHARGE MEASUREMENTS.—Made by wading or from single span bridge.

Channel and control.—Bed composed of small boulders and is fairly smooth. Control not well defined; practically permanent. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 4.9 feet during night of June 13, as determined from high-water marks (discharge, 1,560 second-feet); minimum discharge estimated 26 second-feet March 2.

Ice.—Stage-discharge relation seriously affected by ice for short periods during the winter.

Diversions.—Salvation ditch, which has a decree for 58 second-feet, diverts water above station from middle of May to middle of September. About 6 second-feet is pumped into the river above station from mines at Aspen.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice for short periods during winter. Rating curve well defined below 1,200 second-feet. Gage read to hundredths occasionally until May 9, and thereafter twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair October to May, and good June to September.

Discharge measurements of Roaring Fork at Aspen, Colo., during the year ending Sept. 30. 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 20	W. R. King	1.14	37.0	Feb. 9	T. J. Watkins	1.10	33.5
Jan. 10	T. J. Watkins	1.06	30.7	June 14	W. R. King	4.02	1,040

Daily discharge, in second-feet, of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	65	35	39	32	32	27	40	164	675	875	308	76
2	64	30	40	32	32	26	51	137	675	725	325	72
3	63	31	40	32	32	28	62	123	725	675	255	72
4	62	31	41	32	32	30	54	112	725	638	225	66
5	61	32	42	32	32	30	49	200	875	600	225	63
6	60	32	43	32	34	30	50	248	725	575	212	63
7	58	33	44	31	36	31	49	296	625	625	200	60
8	55	34	45	31	34	31	45	342	725	575	200	55
9	53	36	45	30	32	32	48	462	930	600	225	55
10	54	39	45	28	34	32	53	478	1,150	530	212	142
11	55	37	45	30	33	41	65	492	1,100	485	175	152
12	54	36	45	31	32	45	67	508	1,150	462	152	144
13	53	35	45	32	32	49	71	508	1,320	462	225	123
14	53	36	44	33	32	44	65	420	1,150	400	272	120
15	55	36	43	34	32	38	66	308	1,040	400	225	112
16	57	37	41	31	33	32	67	272	1,040	420	200	105
17	57	37	43	28	33	40	68	240	1,150	360	175	105
18	56	38	45	30	34	48	82	200	1,040	342	164	86
19	56	39	43	32	35	50	79	200	1,040	325	144	82
20	55	39	41	34	37	53	70	240	1,040	290	144	79
21	55	38	39	36	39	60	67	225	930	272	133	76
22	55	38	39	39	34	60	76	200	930	272	116	76
23	53	38	34	37	30	53	94	188	985	240	104	72
24	51	37	32	36	28	48	102	200	825	225	107	86
25	50	37	32	34	27	43	105	240	825	225	100	82
26	49	37	32	32	53	46	109	290	825	225	92	79
27	48	37	32	30	36	49	137	272	875	200	86	68
28	46	38	32	29	33	55	164	325	875	240	83	72
29	44	38	32	28	30	45	212	380	825	225	80	71
30	43	39	32	30	......	40	188	462	875	255	77	67
31	39	......	32	32	......	40	......	575	......	308	75	......

Note.—Discharge estimated because of ice Nov. 13, 27–30, Dec. 1–2, Jan. 8, Feb. 14–17, Mar. 3; also estimated when gage was not read as follows: Oct. 1–5, 7–8, 10, 12–15, 18–21, 23–26, 28–29, 31, Nov. 1, 3–5, 7–9, 11–12, 14–18, 21–26, Dec. 3–7, 9, 12, 14–15, 17, 19–20, 25–28, 30, Jan. 1–4, 6–7, 9, 11–12, 14, 16, 18, 20–21, 23, 25–28, 30, Feb. 1–2, 4, 6, 8, 11, 13, 18–20, 22, 24, 27–28, Mar. 1–2, 5, 7–9, 12, 14–15, 17, 19, 22–24, 26, 29–31, Apr. 1–2, 4, 16, 30, May 6–7, 10–11, and July 4.

Monthly discharge of Roaring Fork at Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	65	39	54.2	3,330
November	39	30	36.0	2,140
December	45	32	39.6	2,430
January	39	28	31.9	1,960
February	53	27	33.6	1,930
March	60	26	41.2	2,530
April	212	40	81.8	4,870
May	575	112	300	18,400
June	1,320	625	922	54,900
July	875	200	421	25,900
August	325	75	171	10,500
September	152	55	86.0	5,120
The year	1,320	26	185	134,000

ROARING FORK BELOW ASPEN, COLO.

Location.—In sec. 1, T. 10 S., R. 85 W., at first highway bridge 2 miles below Aspen, in Pitkin County. Nearest tributary above is Castle Creek; nearest below, Maroon Creek.

Drainage area.—223 square miles (measured on topographic map).

Records available.—October 18, 1913, to September 30, 1916.

Gage.—Vertical staff on right abutment of bridge, facing channel; read at irregular intervals by forest ranger.

Discharge measurements.—Made from two-span bridge.

Channel and control.—Bed composed of gravel and small boulders; shifts occasionally during high water. Control not well defined. Banks high and not subject to overflow.

Extremes of discharge.—Maximum discharge, 2,200 second-feet on June 13, estimated from comparative hydrograph; minimum stage recorded, zero March 3 (discharge, 87 second-feet).

Ice.—Stage-discharge relation not affected by ice except for occasional short periods.

Diversions.—Between this station and the one at Aspen there are a number of small diversions, some of which return the water to the river above the station. The Roaring Fork Light and Power Co. diverts water from Maroon Creek into Castle Creek and thence into Roaring Fork above the station.

Regulation.—None so far as known.

Accuracy.—Stage-discharge relation not permanent; shifts between very narrow limits; affected by ice only for short periods. Rating curve fairly well defined below 3,000 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying gage height to rating table, or for days when gage was not read by estimating from comparison hydrographic records of flow of Roaring Fork at Aspen. Records good, except those for spring months, which are only fair, owing to the probability that one reading does not give the true mean for the day because of diurnal fluctuation due to alternate melting and freezing of snow.

Discharge measurements of Roaring Fork below Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 21	W. R. King	0.25	144	Feb. 9	T. J. Watkins	0.10	104
Jan. 11	T. J. Watkins	.15	105	June 15	W. R. King	2.55	1,870

Daily discharge, in second-feet, of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	185	138	141	104	92	94	114	362	985	1,350	620	255
2	184	135	142	104	92	90	129	307	985	1,280	685	242
3	183	140	143	104	92	87	165	285	1,120	1,280	620	234
4	182	147	143	104	94	101	137	260	1,120	1,080	560	225
5	181	156	144	104	96	101	128	480	1,250	1,100	555	234
6	180	165	144	104	100	101	127	560	1,110	1,060	525	242
7	174	165	144	103	109	99	122	650	1,030	1,070	500	228
8	168	162	144	102	106	98	118	720	1,070	1,160	485	214
9	161	160	138	102	104	98	120	940	1,400	1,090	505	200
10	169	158	131	103	104	102	128	970	2,080	1,030	468	325
11	177	153	131	104	104	104	150	995	2,000	995	430	327
12	175	148	128	100	104	104	161	1,020	2,070	950	387	318
13	173	141	126	97	104	104	188	1,020	2,200	905	387	300
14	175	134	126	107	104	106	170	792	2,070	830	387	298
15	181	132	124	118	104	108	169	620	1,940	830	400	297
16	188	130	123	108	104	109	175	588	1,940	845	414	287
17	158	131	120	99	106	114	175	495	2,070	756	380	278
18	158	133	118	105	108	118	190	495	1,980	730	337	270
19	157	135	117	111	110	132	169	468	1,950	710	337	251
20	156	141	116	108	112	148	165	555	1,960	685	340	260
21	155	144	114	105	114	161	162	500	1,690	650	327	258
22	154	143	115	101	106	161	177	480	1,690	620	320	250
23	154	142	116	105	97	155	230	460	1,820	620	305	248
24	155	141	114	109	99	145	260	495	1,460	620	298	265
25	156	140	112	108	101	128	302	550	1,240	620	297	250
26	157	140	111	107	104	139	280	620	1,240	620	287	240
27	158	140	111	106	101	151	320	620	1,250	600	287	235
28	153	140	111	105	98	135	390	720	1,250	580	287	234
29	149	140	111	104	97	128	468	755	1,280	555	284	230
30	144	141	108	106	....	122	420	790	1,350	555	272	225
31	141	....	104	97	....	116	....	888	....	588	260	....

NOTE.—Discharge estimated by hydrographic comparison with records of flow of Roaring Fork at Aspen, Oct. 1–5, 7–8, 10, 12–15, 18–21, 23–26, 28–29, 31, Nov. 1, 3–5, 7–9, 11, 13–18, 22–26, 28–29, Dec. 1, 3–7, 9, 12, 15, 17, 19–20, 22, 24–28, 30, Jan. 1–3, 5–7, 9–10, 12, 14, 16, 18, 20–21, 23, 25–28, 30, Feb. 8, 11, 13, 15, 17–20, 22, 24–25, 27–28, Mar. 1–2, 5, 7–10, 12, 14–15, 17, 19–20, 22–24, 26, 29–31, Apr. 2, 4, 6–7, 9, 11, 13–14, 16–18, 20–21, 23–24, 26–28, 30, May 3–7, 9–13, 21–23, 25, 28, 30–31, June 4, 6, 9–11, 13–14, 16, 18–20, 22–23, 25–27, 29–30, July 2–6, 9–12, 16, 18–21, 23–25, 27–28, 30–31, Aug. 1, 3–4, 6–9, 11, 13, 15, 17, 20, 22–25, 27, 29–30, Sept. 1, 3, 5, 7–8, 10, 12–15, 17–18, 21–27, 29. Discharge estimated because of ice, Nov. 12, 27, Dec. 2, and Feb. 1–6. Shifting-control method used Oct. 1 to Nov. 10, and Dec. 8 to Jan. 24.

Monthly discharge of Roaring Fork below Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	188	141	166	10,200
November	165	130	144	8,570
December	144	104	125	7,690
January	118	97	105	6,460
February	114	92	102	5,870
March	161	87	118	7,260
April	468	114	200	11,900
May	1,020	260	628	38,600
June	2,200	985	1,550	92,200
July	1,350	555	850	52,300
August	685	260	405	24,900
September	327	200	257	15,300
The year	2,200	87	388	281,000

ROARING FORK AT GLENWOOD SPRINGS, COLO.

Location.—In sec. 9, T. 6 S., R. 89 W., about 1,500 feet above mouth of river in Glenwood Springs, Garfield County.

Drainage area.—1,450 square miles (measured on Nell's map of Colorado, edition of 1903).

Records available.—April 6, 1906, to September 30, 1909; September 21, 1910, to September 30, 1916.

Gage.—Inclined staff on left bank 800 feet above highway bridge, used since November 20, 1915. Chain gage on downstream side of highway bridge previously used. Read by employees of United States Forest Service.

Discharge measurements.—Made from highway bridge.

Channel and control.—Bed composed of boulders and coarse gravel; shifts slightly between narrow limits. Control not well defined. Banks high and not subject to overflow. Gage was moved to eliminate effect of backwater during extremely high stages on Grand River.

Extremes of discharge.—Maximum stage recorded during year, 5.6 feet on June 13–14, 19 and 20 (discharge, 8,520 second-feet); minimum stage recorded, 0.70 foot at 4 p. m. March 3 (discharge, 300 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice, as river seldom freezes over and slush or anchor ice forms only occasionally.

Diversions.—There are court decrees for diversion of 164 second-feet from Roaring Fork between Glenwood Springs and lower Aspen station.

Regulation.—None.

Accuracy.—Stage-discharge relation shifted between narrow limits; not affected by ice during 1916. Rating curves well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table Records good.

Discharge measurements of Roaring Fork at Glenwood Springs, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	W. R. King	1.18	462	Apr. 25	W. R. King	2.28	1,640
20	do	[a] 1.00	477	June 16	do	5.33	7,780
Jan. 9	T. J. Watkins	.95	524	July 22	do	2.98	2,620
Feb. 6	do	.85	382				

[a] Stage read on new gage installed this date; reading on old gage 1.34 feet.

Daily discharge, in second-feet, of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	615	455	485	420	342	390	670	1,820	5,050	5,990	2,690	998
2	615	480	414	420	350	300	670	1,580	4,830	5,750	3,030	986
3	588	430	485	452	388	300	670	1,470	5,050	5,510	3,030	976
4	588	455	485	485	388	420	710	1,580	5,640	5,280	3,030	965
5	532	480	468	420	388	452	670	1,820	6,280	5,050	2,690	875
6	505	455	452	420	388	485	630	2,690	5,510	4,830	2,460	875
7	505	480	420	360	388	452	592	3,440	5,280	4,390	2,220	875
8	505	480	420	420	388	452	592	4,180	5,050	5,050	2,080	875
9	532	480	408	420	370	420	631	4,830	6,220	4,830	2,220	875
10	480	588	452	420	370	485	670	5,280	7,470	4,610	2,080	875
11	480	480	420	390	370	485	832	5,050	7,730	4,180	2,220	1,470
12	455	430	436	390	370	520	920	4,830	7,990	3,770	2,080	1,360
13	455	455	452	485	350	555	965	4,610	8,520	3,680	2,470	1,360
14	480	430	420	420	330	555	920	3,910	8,520	3,580	2,800	1,260
15	480	405	420	420	370	485	965	3,210	7,990	3,580	2,220	1,260
16	532	480	452	420	370	520	1,010	2,530	7,990	3,480	1,950	1,060
17	518	455	306	420	370	555	1,060	2,220	7,990	3,390	1,700	1,080
18	505	455	378	420	360	555	1,210	2,080	8,250	3,390	1,580	1,110
19	505	455	369	420	350	672	1,210	2,080	8,520	3,030	1,580	1,030
20	532	505	360	360	355	790	1,090	2,530	8,520	2,860	1,470	950
21	455	520	420	420	360	1,260	965	2,450	7,730	2,690	1,360	875
22	505	485	452	360	390	965	1,000	2,370	6,970	2,690	1,260	875
23	455	485	452	370	390	875	1,260	2,080	5,990	2,460	1,260	875
24	455	520	420	380	360	832	1,470	2,370	6,470	2,220	1,110	898
25	455	470	420	390	360	790	1,700	2,690	6,110	2,370	1,160	920
26	480	420	420	390	360	750	1,820	3,030	5,750	2,530	1,110	875
27	480	485	300	405	375	710	2,080	2,860	6,470	2,370	1,040	832
28	455	452	360	390	390	670	2,370	3,320	6,230	3,030	965	790
29	430	390	420	360	360	790	3,030	3,770	6,230	3,030	875	790
30	430	520	452	348	....	710	2,420	4,180	6,110	3,030	1,060	832
31	455	....	436	335	....	630	....	4,610	....	3,030	1,010	....

NOTE.—Discharge estimated or interpolated Oct. 17, 24, Nov. 25, Dec. 5, 12, 19, 25, 31, Jan. 9, 16, 23–24, 31, Feb. 13, 20, 27, Mar. 5, 12, 19, 25–26, Apr. 2, 9, 16, 23, 30, May 7, 12, 14, 21, 28, June 4, 11, 17–18, 25, 30, July 2, 9, 13, 16, 23, 29–30, Aug. 3, 6, 12–13, 19–20, 27, Sept. 1–3, 10, 17, 19–20, 22, 24.

Monthly discharge of Roaring Fork at Glenwood Springs, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	615	430	499	30,700
November	588	390	469	27,900
December	485	300	425	26,100
January	485	335	404	24,800
February	390	330	369	21,200
March	1,260	300	609	37,400
April	3,030	592	1,160	69,000
May	5,280	1,470	3,080	189,000
June	8,520	4,830	6,750	402,000
July	5,990	2,220	3,730	229,000
August	3,030	875	1,870	115,000
September	1,470	790	989	58,800
The year	8,520	300	1,700	1,230,000

CASTLE CREEK NEAR ASPEN, COLO.

Location.—In sec. 35, T. 10 S., R. 85 W., 75 feet below highway bridge, in Sopris National Forest, 4½ miles above Aspen, in Pitkin County. No inflow below except spring run-off from small gulches; Conundrum Creek, enters about a mile upstream.

Drainage area.—72 square miles (measured on topographic map).

Records available.—February 16, 1911, to September 30, 1916.

Gage.—Gurley water-stage recorder on left bank 75 feet below bridge. Staff on opposite bank at datum 1.0 foot higher than present gage, used February 16, 1911, to February 28, 1912. Vertical staff on right abutment of bridge at present datum used February 29, 1912, to April 11, 1915, but owing to slope of stream gage readings were somewhat higher.

Discharge measurements.—Made from cable 22 feet below gage or by wading nearby.

Channel and control.—Bed composed of coarse gravel; shifts during high water. Control is small rapids just below cable. Left bank high and not subject to overflow; right bank is overflowed for 75 feet at gage height 4.3 feet.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.22 feet at midnight June 17 (discharge, 577 second-feet); minimum stage, 0.42 foot on February 1 (discharge, 26 second-feet).

Ice.—Stage-discharge relation affected by ice occasionally for short periods.

Diversions.—No water diverted above station except possibly for a small amount of meadow irrigation; there are court decrees for diversion of 160 second-feet below station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during year; affected by ice for a few short periods. Rating curve well defined below 500 second-feet. Operation of water-stage recorder satisfactory. Daily discharge determined by applying to rating table daily gage height obtained by inspecting gage-height graph. Records excellent.

Discharge measurements of Castle Creek near Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 22	W. R. King	0.70	37.8	Feb. 8	T. J. Watkins	0.60	29.2
Jan. 11	T. J. Watkins	.52	27.3	June 14	W. R. King	2.73	446

Daily discharge, in second-feet, of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	53	37	36	34	31	33	33	77	206	494	280	105
2	52	37	35	34	34	32	34	74	206	452	290	103
3	53	37	35	34	34	33	34	68	219	502	249	97
4	52	37	35	34	32	33	34	70	253	458	244	96
5	51	37	34	34	32	33	34	81	270	473	237	95
6	50	37	34	34	32	33	34	105	246	445	230	99
7	48	38	34	34	32	32	34	139	249	432	206	92
8	48	37	34	33	32	32	34	156	270	455	199	86
9	48	37	34	33	32	32	35	181	322	370	223	141
10	48	37	34	31	32	33	36	186	382	372	219	150
11	46	34	34	29	32	34	38	184	412	330	195	133
12	45	32	34	32	32	33	39	184	434	324	188	113
13	43	31	34	34	32	34	40	181	455	337	221	107
14	43	34	34	34	34	32	37	169	463	334	244	101
15	43	37	33	34	34	32	37	141	468	334	203	95
16	43	41	33	33	34	32	38	125	478	350	190	81
17	43	40	33	33	34	33	41	117	484	347	173	85
18	43	40	31	32	36	34	42	111	504	352	181	81
19	42	40	31	33	34	34	42	119	510	322	158	78
20	42	38	31	32	33	35	40	129	481	317	154	75
21	42	37	31	31	32	37	40	121	455	310	143	74
22	42	36	31	30	32	35	42	113	422	297	135	72
23	42	36	31	30	33	36	46	105	394	290	129	74
24	42	36	31	30	32	35	49	103	430	280	129	75
25	40	34	31	30	32	34	51	109	438	314	129	72
26	40	34	32	30	32	35	56	115	448	310	123	70
27	38	35	32	30	34	34	63	115	457	284	117	67
28	37	34	32	30	33	35	72	129	466	260	111	67
29	37	35	33	32	32	34	92	148	475	255	111	64
30	37	36	34	32	....	34	86	175	484	250	115	64
31	37	....	34	31	....	34	....	199	....	244	109	....

NOTE.—Discharge estimated because of ice, Dec. 13–16, 20–24, Jan. 23–27; also estimated when water stage recorder failed to operate, Nov. 12, 14–15, 17, 21, Dec. 25–27, 29, 31, Jan. 1–2, 4–10, June 25–30, and July 29–30. Shifting-control method used July 4 to Sept. 30.

Monthly discharge of Castle Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	53	37	44.2	2,720
November	41	31	36.4	2,170
December	36	31	33.1	2,040
January	34	29	32.2	1,980
February	36	31	32.8	1,890
March	37	32	33.6	2,070
April	92	33	44.4	2,640
May	199	68	130	7,990
June	510	206	393	23,400
July	502	244	351	21,600
August	290	109	182	11,200
September	150	64	90.4	5,380
The year	510	29	117	85,100

MAROON CREEK NEAR ASPEN, COLO.

LOCATION.—In sec. 22, T. 10 S., R. 85 W., just above the Roaring Fork Light & Power Co.'s head gate, and 5 miles above Aspen, Pitkin County, in the Sopris National Forest. Nearest tributary, Willow Creek, enters just below station.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—January 1, 1911, to September 30, 1916.

GAGE.—Vertical staff on right bank 100 feet above canal head gate; read by Harry Burnett.

Discharge measurements.—Made by wading at points near gage.

Channel and control.—Bed composed of compacted gravel; shifts occasionally. Banks not subject to overflow to any great extent.

Extremes of discharge.—Maximum stage recorded during year, 2.20 feet at 5.45 a. m. July 4 (discharge, 365 second-feet); minimum stage, 0.40 foot at 8.40 a. m. March 6 caused by snow slide (discharge, 16 second-feet).

Ice.—Stage-discharge relation not affected by ice except occasionally for short periods.

Diversions.—One or two small diversions above station; the Roaring Fork Light & Power Co. diverts water just below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent during year; affected by ice for a few short periods. Rating curve fairly well-defined below 300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good, except those for spring months which are only fair, owing to the diurnal fluctuation due to alternate melting and freezing of snow.

Discharge measurements of Maroon Creek near Aspen, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 11	T. J. Watkins	0.68	25.3
Feb. 8	do	.65	21.5
June 13	W. R. King	1.90	340

Daily discharge, in second-feet, of Maroon Creek near Aspen, Colo., for the year ending Sept. 30. 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	31	28	26	24	22	23	40	155	334	272	129
2	37	31	28	25	25	22	23	40	163	334	288	117
3	37	31	28	24	27	22	23	39	171	350	272	110
4	37	30	28	24	25	22	23	42	182	365	272	103
5	37	30	28	24	24	22	23	44	199	350	266	103
6	36	29	28	24	24	23	23	53	196	350	260	98
7	36	29	28	24	24	24	23	68	196	350	253	96
8	36	28	27	25	24	23	24	83	205	350	247	92
9	35	28	28	26	24	22	24	96	220	350	241	96
10	34	28	27	26	24	23	24	110	235	334	241	117
11	34	28	28	26	23	23	25	115	256	334	229	115
12	34	28	27	24	23	22	26	117	272	334	226	105
13	34	28	27	25	23	22	25	119	272	318	235	103
14	34	29	26	25	23	23	25	115	288	318	247	96
15	36	30	27	25	23	22	25	110	288	303	229	92
16	36	29	26	25	23	22	26	107	303	303	226	90
17	34	28	26	25	23	22	27	105	303	303	217	90
18	34	28	26	26	23	23	28	105	318	303	214	83
19	34	29	27	28	23	25	27	105	334	303	208	83
20	33	29	28	30	23	24	28	77	334	303	205	79
21	33	29	28	27	22	28	28	112	318	288	196	79
22	33	29	27	27	22	25	28	110	318	288	194	75
23	33	29	27	24	22	25	29	105	303	288	191	75
24	33	29	26	24	22	24	30	101	303	272	182	72
25	31	28	26	24	22	24	34	103	303	288	179	72
26	31	28	26	24	22	24	36	105	303	272	174	66
27	30	28	26	24	22	24	39	110	318	272	168	64
28	30	28	30	27	22	24	41	115	318	272	160	64
29	30	30	26	24	22	24	45	122	334	272	155	61
30	31	29	26	24	......	23	42	129	334	272	155	61
31	31	......	26	24	......	23	......	145	......	272	145	......

Note.—Discharge estimated Dec. 18-20, 25, Jan. 7-9, 18, Feb. 13, and Mar. 5-6, because of snow and ice.

Monthly discharge of Maroon Creek near Aspen, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	38	30	33.9	2,080
November	31	28	28.9	1,720
December	30	26	27.1	1,670
January	30	24	25.2	1,550
February	27	22	23.2	1,330
March	28	22	23.3	1,430
April	45	23	28.2	1,680
May	145	39	95.1	5,850
June	334	155	268	15,900
July	365	272	311	19,100
August	288	145	218	13,400
September	129	61	89.5	5,330
The year	365	22	97.9	71,000

FRYINGPAN CREEK AT NORRIE, COLO.

Location.—In sec. 28, T. 8 S., R. 83 W., at highway bridge in Norrie, Pitkin County in the Sopris National Forest. North Fork enters 1 mile below.

Drainage area.—92 square miles (measured on topographic map).

Records available.—February 18, 1911, to September 30, 1916.

Gage.—Vertical staff on downstream side of center pier; read by forest ranger. From February 18, 1911, to July 13, 1915, gage was located at side of pier and although referred to same datum gave a considerably higher reading during high-water stages as the water piled up against it. On August 20, 1915, gage datum was raised 1 foot.

Discharge measurements.—Made from bridge, or by wading.

Channel and control.—Bed composed of boulders. Current not greatly disturbed as at ordinary stages a pool is formed by the control located 100 feet downstream at well-defined rapids which are practically permanent. Banks high and not subject to overflow.

Extremes of discharge.—Maximum discharge of 1,040 second-feet June 11 (estimated from comparative hydrograph); minimum discharge of 17 second-feet occurred November 17 when stage-discharge relation was affected by ice.

Ice.—Stage-discharge relation seriously affected by ice; daily discharge determined from observer's notes, discharge measurements, and weather records.

Diversions.—None above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice for occasional short periods. Rating curve well defined below 1,000 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying to rating table daily-gage height, or for days on which gage was not read, by estimating discharge from hydrographic comparison with records of flow of Fryingpan Creek at Thomasville and North Fork of Fryingpan Creek near Norrie. Records only fair because of infrequent gage readings, and probable error due to diurnal fluctuation.

Discharge measurements of Fryingpan Creek at Norris, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	[a]1.59	26.4	Feb. 10	T. J. Watkins	1.48	24.4
23	.....do	[a]1.58	25.1	June 12	W. R. King	3.82	788
Jan. 12	T. J. Watkins	1.45	20.8				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Fryingpan Creek at Norris, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	45	26	24	24	25	32	60	180	605	515	298	83
2	50	25	22	24	26	32	40	130	620	650	262	79
3	50	23	26	24	25	32	47	103	650	580	250	72
4	44	22	26	24	24	33	47	166	640	480	228	65
5	37	22	26	24	24	34	45	220	620	435	195	58
6	37	23	26	24	25	35	40	280	605	375	190	74
7	37	24	26	24	26	37	37	495	605	395	185	70
8	37	26	26	24	25	40	37	455	605	420	180	65
9	37	22	26	24	25	42	46	628	740	440	210	96
10	44	26	28	23	24	44	56	560	980	455	210	126
11	55	32	26	23	25	47	76	605	1,040	395	166	114
12	37	31	25	22	26	48	78	605	930	380	166	103
13	38	29	26	22	26	50	69	538	785	355	190	108
14	40	26	26	23	26	52	69	500	760	315	245	96
15	38	21	26	23	25	54	69	375	740	298	220	83
16	37	18	26	24	25	57	60	315	740	280	180	78
17	44	17	26	24	26	60	65	315	785	260	180	76
18	40	19	26	22	27	65	95	280	840	245	147	74
19	37	19	26	22	27	70	90	228	740	262	139	65
20	37	21	26	22	28	108	80	195	695	240	134	65
21	38	24	26	23	28	139	89	210	680	210	126	62
22	37	26	25	24	29	85	108	245	645	200	117	58
23	40	26	23	25	29	62	108	195	620	180	110	62
24	40	30	22	26	30	79	120	375	605	180	108	66
25	36	25	22	25	30	53	126	460	605	180	114	69
26	32	28	23	24	31	65	152	375	605	180	114	62
27	30	30	24	24	31	65	186	335	605	195	106	58
28	27	26	24	24	32	65	287	380	605	228	99	54
29	26	24	24	24	32	58	262	435	605	228	93	50
30	26	24	24	24	......	50	210	495	550	260	93	50
31	26	......	24	24	......	69	......	560	......	315	90	......

NOTE.—Discharge estimated Nov. 12 to Dec. 2, Feb. 19–25, Mar. 13–19, because of ice; also estimated from hydrographic comparisons for the following days on which gage was not read: Oct. 1, 3, 6–7, 10–11, 13, 15, 17–18, 25, 27, 31, Nov. 2–3, 6–7, Dec. 5–6, 8, 12, 15–16, 18–20, 22–23, 25–26, 28–29, 31, Jan. 1–3, 5, 7, 10–11, 13–16, 21–23, 25, 27–28, 30, Feb. 1, 3–4, 6, 8–9, 13, 16, 18, 20, 26–27, 29, Mar. 4–6, 9, 12, 22, 27, Apr. 2, 9, 14, 16, 19–20, 23–24, 30, May 2, 5, 14, 18, 21, 25, 28, June 2, 4–5, 11, 14, 18, 21–23, 30, July 3–4, 8–9, 12, 16–17, 20, 22, 26, 30, Aug. 3, 6–7, 13, 16, 20, 23, 27, 31, Sept. 3–4, 7, 9, 11, 14, 17, 21, 23–24, 30.

Monthly discharge of Fryingpan Creek at Norrie, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	55	26	38.0	2,340
November	32	17	24.5	1,460
December	28	22	25.0	1,540
January	26	22	23.6	1,450
February	32	24	27.0	1,550
March	139	32	56.7	3,490
April	287	37	95.0	5,650
May	628	103	363	22,300
June	1,040	550	698	41,200
July	650	180	327	20,100
August	298	90	166	10,200
September	126	50	74.7	4,440
The year	1,040	17	159	116,000

FRYINGPAN CREEK AT THOMASVILLE, COLO.

Location.—In sec. 7, T. 8 S., R. 83 W., at private bridge 1,000 feet southwest of railroad station at Thomasville, in Pitkin County. Nearest tributary, Deadman Gulch, enters a quarter of a mile below.

Drainage area.—175 miles (measured on Forest atlas and topographic maps).

Records available.—February 26, 1915, to September 30, 1916. From January 2, 1911, to February 25, 1915, station was maintained 1 mile downstream where drainage area was 190 square miles.

Gage.—Vertical staff on upstream side of right-bridge abutment; read by J. H. Swineford. Gage at original section was vertical staff attached to side of center bridge pier. No determined relation between two gages.

Discharge measurements.—Made from single span bridge or by wading.

Channel and control.—Bed composed of large boulders; rough. Control not well defined; shifts between narrow limits. Banks not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 4.9 feet at 2.50 p. m. June 20 (discharge, 1,580 second-feet); minimum discharge, 33 second-feet December 29, when stage-discharge relation was affected by ice.

Ice.—Stage-discharge relation affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

Diversions.—No court decrees for diversion of water above station.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent; shifted between narrow limits at very low stages; affected by ice for occasional short periods. Rating curve well defined below 1,800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good, except those for spring months, which are only fair, owing to possible error in mean gage height due to diurnal fluctuation caused by alternate melting and freezing of snow.

Discharge measurements of Fryingpan Creek at Thomasville, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	1.31	48.1	Feb. 10	T. J. Watkins	1.22	47.5
Jan. 12	T. J. Watkins	[a] 1.45	42.8	June 11	W. R. King	4.75	1,490

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	72	46	46	40	40	81	130	285	675	575	480	87
2	76	43	43	39	41	85	120	320	625	575	355	87
3	76	44	50	40	42	85	102	480	675	550	355	87
4	72	44	46	38	43	94	106	575	675	550	395	94
5	69	44	43	40	44	90	102	575	725	525	355	102
6	68	41	44	38	45	102	116	625	775	525	320	87
7	70	44	42	37	46	90	116	575	775	525	320	87
8	84	46	44	38	47	102	111	525	940	525	338	90
9	75	48	44	38	48	102	102	435	1,100	525	320	221
10	69	57	43	37	49	102	116	480	1,100	525	302	221
11	87	56	45	38	48	102	111	480	1,160	502	285	221
12	86	55	40	36	48	111	141	480	1,160	502	302	215
13	72	51	41	37	48	106	135	480	1,160	480	302	206
14	68	46	42	40	48	106	135	435	1,220	435	302	192
15	64	46	40	38	48	120	153	435	1,280	395	320	165
16	66	45	40	42	49	116	192	502	1,280	355	320	130
17	75	42	38	40	51	120	165	525	1,400	338	252	124
18	70	46	39	37	54	124	160	550	1,460	320	221	120
19	66	46	38	38	56	130	178	550	1,400	320	192	116
20	69	49	37	40	58	153	178	550	1,520	320	187	111
21	70	49	39	39	60	192	170	502	1,460	320	165	111
22	68	45	40	39	62	170	187	525	1,400	320	170	111
23	64	46	39	42	64	153	192	525	1,100	285	170	102
24	57	56	38	42	66	160	206	575	995	320	165	99
25	56	46	37	44	68	178	178	600	940	302	170	87
26	51	52	36	44	71	141	187	600	885	285	160	85
27	51	55	35	43	73	137	187	600	725	285	120	85
28	49	46	34	44	75	124	221	600	625	320	106	81
29	49	46	33	42	77	124	187	575	675	320	124	85
30	49	46	35	41	....	124	192	625	625	355	130	81
31	51	....	37	40	....	137	....	625	....	502	111	....

NOTE.—Discharge, Nov. 29-30, Dec. 24-31, Jan. 30-31, Feb. 1-6 and 16-29 estimated because of ice. Shifting-control method used Feb. 7-8.

Monthly discharge of Fryingpan Creek at Thomasville, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	87	49	66.7	4,100
November	57	41	47.5	2,830
December	50	33	40.3	2,480
January	44	36	39.7	2,440
February	77	40	54.1	3,110
March	192	81	121	7,440
April	221	102	153	9,100
May	625	285	523	32,200
June	1,520	625	1,020	60,700
July	575	285	419	25,800
August	480	106	252	15,500
September	221	81	123	7,320
The year	1,520	33	238	173,000

NORTH FORK OF FRYINGPAN CREEK NEAR NORRIE, COLO.

LOCATION.—In sec. 21, T. 8 S., R. 83 W., at highway bridge about a mile from Norrie, Pitkin County, in the Sopris National Forest. No tributaries below station.

DRAINAGE AREA.—42 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 18, 1911, to September 30, 1916.

GAGE.—Vertical staff on downstream side of right bridge abutment; read by employees of United States Forest Service.

DISCHARGE MEASUREMENTS.—Made from bridge, or by wading.

Channel and control.—Bed composed of small boulders; rough. Control not well defined; shifts between narrow limits. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 2.45 feet June 14 (discharge, 418 second-feet); minimum discharge 6 second-feet during January and February when stage-discharge relation was affected by ice.

Ice.—Stage-discharge relation affected by ice; discharge determined from observer's notes, discharge measurements, and weather records.

Diversions.—None above station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve fairly well defined below 450 second-feet. Gage read to hundredths at irregular intervals. Daily discharge ascertained by applying to rating table daily gage height, or, for days when gage was not read, by estimating from a hydrographic comparison with records of flow at other stations on Fryingpan Creek. Records only fair because of infrequent gage readings and probable error due to diurnal fluctuation.

Discharge measurements of North Fork of Fryingpan Creek near Norrie, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	W. R. King	0.32	14.5	Feb. 10	T. J. Watkins	.20	7.4
Jan. 12	T. J. Watkins	[a].25	5.7	June 12	W. R. King	2.30	383

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	17	8	13	6	6	9	35	105	248	198	77	25
2	16	8	13	6	6	9	38	82	255	186	84	19
3	14	8	13	6	6	9	41	58	262	174	84	18
4	13	8	12	6	6	9	36	110	262	162	84	16
5	13	8	12	6	6	8	32	120	262	152	74	16
6	12	8	12	6	7	8	32	152	262	141	52	16
7	10	9	12	6	7	8	28	222	222	141	52	16
8	10	9	11	6	7	8	25	235	263	141	52	16
9	10	10	10	6	7	8	29	319	304	141	52	16
10	10	10	10	6	7	9	33	304	366	141	42	34
11	10	10	10	6	7	10	56	262	383	152	32	52
12	10	9	11	6	7	11	58	255	400	114	42	41
13	11	9	11	6	7	12	60	248	383	101	42	41
14	12	9	12	6	7	14	58	200	400	92	120	41
15	12	8	11	6	7	15	58	152	366	92	120	33
16	12	8	11	6	7	16	58	141	319	92	46	25
17	11	8	10	6	8	18	58	130	334	92	44	25
18	10	10	10	7	8	24	77	120	350	92	41	25
19	14	12	10	7	8	31	64	110	350	92	38	23
20	12	14	10	7	8	36	52	110	366	64	36	22
21	12	14	10	7	8	101	58	110	335	64	34	19
22	12	14	9	7	8	58	64	115	304	64	32	18
23	11	14	9	7	8	41	82	120	283	62	28	18
24	11	14	9	7	8	58	101	152	262	60	25	18
25	11	14	8	7	8	31	106	163	242	58	26	19
26	10	14	8	7	9	41	110	174	222	55	26	19
27	10	14	8	6	9	41	160	152	216	52	28	18
28	9	14	7	6	9	36	152	169	210	64	22	16
29	9	13	7	6	9	36	174	186	216	64	22	16
30	8	13	7	6	......	32	130	204	222	82	22	16
31	8	......	7	6	......	32	......	222	......	101	24	......

Note.—Discharge Nov. 13–17, and Dec. 23 to Feb. 7 estimated because of ice; also estimated Oct. 3, 10, 17, 24, 29–31, Nov. 2–3, 5, 8–9, 11–12, 18–19, 21–22, 24, 26, 28–29, Dec. 2, 5, 8, 10, 12–13, 15–16, 18–20, 22, Feb. 8, 12–13, 15, 18, 20, 24, 26–27, 29, Mar. 1, 4–6, 8–9, 12, 15–16, 18, Apr. 1–2, 9, 12, 15–16, 19, 23, 25, 27–28, May 2, 12, 14, 18, 20, 22, 25, 28, 30, June 2, 4–5, 8, 17–18, 21, 23, 25, 27, 29, July 2–4, 7, 9, 15–16, 21, 23–24, 28, 30, Aug. 3, 7–8, 10, 12–13, 15, 17, 19–21, 23, 29, 31, Sept. 3, 5–6, 8, 10, 15, 17, 23–25, 29–30. Shifting-control method used Nov. 20 to Dec. 21.

Monthly discharge of North Fork of Fryingpan Creek near Norrie, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	17	8	11.3	695
November	14	8	10.7	637
December	13	7	10.1	621
January	7	6	6.29	387
February	9	6	7.41	426
March	101	8	25.1	1,540
April	174	25	67.8	4,030
May	319	58	168	10,300
June	400	210	296	17,600
July	198	52	106	6,520
August	120	22	48.5	2,980
September	52	16	23.2	1,380
The year	400	6	64.9	47,100

CRYSTAL RIVER AT MARBLE, COLO.

Location.—In sec. 26, T. 11 S., R. 88 W., at electric railway bridge of Colorado-Yule Marble Co. at Marble, in Gunnison County. Nearest tributary, Carbonate Creek, enters at Marble.

Drainage area.—77 square miles (measured on map in Forest Atlas).

Records available.—November 1, 1910, to September 30, 1916.

Gage.—Vertical hook gage on downstream side of left abutment; read by F. V. Mueller.

Discharge measurements.—Made by wading or from cable a short distance below bridge.

Channel and control.—Bed slightly rocky but has been cleared and is smooth at measuring section; shifts between narrow limits. Banks subject to slight overflow but all water passes under cable and bridge.

Extremes of stage.—Maximum stage recorded during year, 7.34 feet at 10 p. m. June 29; minimum stage recorded, 1.24 feet at 5 p. m. January 25 (caused by snowslide).

Ice.—Stage-discharge relation little if at all affected by ice but occasionally affected by snowslides.

Diversions.—Court decrees for diversion of 114 second-feet below station; none for diversions above.

Regulation.—None.

No discharge measurements were made at this station during the year. Data inadequate for determination of flow.

Daily gage-heights, in feet, of Crystal River at Marble, Colo., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	1.88	1.81	1.88	2.10	2.24	4.08	6.36	4.06	2.70
2	....	1.64	1.72	1.83	2.06	2.28	4.14	....	3.97	2.67
3	....	1.70	1.85	1.82	2.09	2.28	4.28	....	4.00	2.70
4	....	1.90	....	1.80	2.16	2.34	4.24	....	3.96	2.60
5	....	1.92	....	1.80	2.10	2.38	4.51	....	3.91	2.58
6	....	1.87	....	1.86	2.11	2.36	4.56	....	3.87	2.58
7	....	1.84	....	1.85	2.19	2.46	4.56	....	3.88	2.44
8	....	1.90	1.68	1.73	2.10	2.42	4.64	....	3.84	2.48
9	....	1.79	1.71	1.82	2.14	2.52	4.60	....	3.49	2.46
10	....	1.80	1.82	1.85	2.15	2.60	4.76	....	3.54	2.42
11	....	1.84	1.81	1.84	2.14	2.56	4.82	....	3.42	2.46
12	....	1.84	....	1.76	2.12	2.49	5.02	....	3.42	2.74
13	....	1.76	....	1.74	2.10	2.55	4.80	....	3.35	2.95
14	....	1.92	....	1.70	2.12	2.54	4.84	....	3.22	3.10
15	1.92	1.87	....	1.72	2.08	2.56	4.90	....	3.18	2.90
16	1.93	1.86	....	1.82	2.06	2.48	4.83	4.84	3.18	2.76
17	1.89	1.78	....	1.86	2.21	2.61	4.90	4.70	3.12	....
18	1.89	1.91	....	1.82	....	2.56	5.18	4.78	3.13	....
19	1.92	1.88	....	1.85	2.18	2.70	5.40	4.72	3.08	....
20	1.91	1.85	....	[a]1.58	2.16	2.72	5.40	4.60	3.08	2.54
21	1.90	1.84	....	1.78	2.12	2.84	5.38	4.55	2.97	2.54
22	1.83	1.74	....	1.80	2.15	3.06	5.44	4.68	2.98	2.53
23	1.76	1.85	....	1.88	2.25	2.98	5.56	4.54	2.92	2.57
24	....	1.88	....	1.83	2.21	3.16	5.64	4.40	2.91	2.55
25	....	[a]1.30	....	1.86	2.20	3.25	5.71	4.28	2.76	2.60
26	1.85	1.90	....	1.86	2.20	3.22	5.83	4.12	2.84	2.50
27	....	1.86	....	1.85	2.23	3.38	5.82	4.22	2.73	2.48
28	1.80	1.80	....	1.90	2.23	3.59	6.66	4.20	2.84	2.46
29	1.89	1.78	....	1.92	2.12	3.89	6.90	4.08	2.78	2.45
30	1.94	1.82	....	1.94	2.16	4.10	6.57	4.14	2.84	2.50
31	1.98	1.76	....	2.01	....	4.24	....	4.10	2.72	....

[a] Affected by snowslide above gage.

TAYLOR RIVER AT ALMONT, COLO.

Location.—In sec. 22, T. 51 N., R. 1 E., at highway bridge at Almont, in Gunnison County, 300 feet above junction of Taylor and East rivers.

Drainage area. 413 square miles (measured on map in Forest Atlas).

Records available. July 27, 1910, to September 30, 1916.

Gage.—Vertical staff on downstream side of center pier; read by Sam Ogden.

Discharge measurements.—Made from bridge.

Channel and control.—Bed composed of small boulders and coarse gravel; banks not subject to overflow. Control practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 4.20 feet at 6.05 a. m. June 17 (discharge, 2,980 second-feet); minimum discharge occurred during winter, when record was discontinued.

Ice.—Stage-discharge relation affected by ice during winter months. Data insufficient to determine winter flow.

Diversions.—No court decrees for diversions from Taylor River.

Regulation.—None.

Accuracy.—Stage-discharge relation shifted between narrow limits; affected by ice December 1 to March 6. Rating curves fairly well defined below 2,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Cooperation.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of Taylor River at Almont, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 28	W. R. King	2.71	565	July 10	Robert Follansbee	3.15	1,030
June 20	.....do	3.70	1,920	Sept. —	B. T. Chase	2.10	242

Daily discharge, in second-feet, of Taylor River at Almont, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	258	178	....	258	478	1,140	1,380	780	276
2	258	178	....	258	415	1,340	1,310	690	276
3	235	178	....	258	385	1,640	1,310	650	276
4	215	178	....	258	478	1,640	1,180	650	276
5	215	178	....	258	778	1,480	1,180	610	276
6	178	178	....	258	968	1,340	1,050	500	276
7	178	178	305	258	1,200	1,340	935	500	276
8	178	178	258	258	1,410	1,480	935	500	276
9	178	178	258	258	1,640	1,710	990	500	276
10	178	178	280	258	1,780	1,940	1,050	500	405
11	178	178	280	258	1,640	2,240	1,050	378	455
12	178	178	258	280	1,340	2,240	1,050	435	378
13	178	178	258	280	1,080	2,240	990	500	325
14	178	178	258	280	1,080	2,380	935	435	325
15	195	178	235	280	1,080	2,380	830	535	325
16	195	178	215	305	968	2,380	830	572	325
17	178	178	215	305	968	2,740	735	500	325
18	178	178	215	305	868	2,510	735	435	325
19	178	178	258	305	868	2,280	650	405	325
20	178	178	258	330	778	1,880	650	378	325
21	178	178	258	415	778	1,980	572	378	325
22	178	178	258	415	778	1,700	572	378	300
23	178	178	280	415	778	1,380	500	325	276
24	178	178	305	415	778	1,240	500	325	276
25	178	178	305	510	778	1,380	500	325	276
26	178	178	305	545	778	1,380	435	300	276
27	178	178	305	580	778	1,380	435	276	276
28	178	195	258	655	778	1,380	535	276	276
29	178	178	258	695	868	1,380	610	276	232
30	178	178	258	618	968	1,380	735	276	232
31	178	....	258	....	1,140	....	780	276	....

NOTE.—Discharge Nov. 29–30 estimated because of ice. Gage read but data inadequate for determination of discharge Jan. 1 to Mar. 6.

Monthly discharge of Taylor River at Almont for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	258	178	188	11,600
November	195	178	179	10,700
March 7-31	305	215	264	13,100
April	695	258	359	21,400
May	1,780	385	948	58,300
June	2,740	1,140	1,760	105,000
July	1,380	435	837	51,500
August	780	276	447	27,500
September	405	232	301	17,900

GUNNISON RIVER NEAR GUNNISON, COLO.

Location.—In sec. 3, T. 49 N., R. 1 W., at highway bridge 2 miles southwest of Gunnison, in Gunnison County. Nearest tributary, Tomichi Creek, enters 1 mile below.

Drainage area.—1,010 square miles (measured on map in Hayden's atlas).

Records available.—November 27, 1910, to November 30, 1914; April 27 to September 30, 1916.

Gage.—Bristol water-stage recorder on downstream side of right abutment used April 27 to September 30, 1916; datum 0.15 foot higher than that of chain gage on upstream side of bridge used prior to November 30, 1914. Observer, C. W. Chinery.

Discharge measurements.—Made from single-span bridge, or by wading.

Channel and control.—Bed composed of coarse gravel and small boulders; will shift during high water. Control at well-defined rapids below bridge; will shift occasionally. Banks not subject to overflow.

Extremes of discharge.—Maximum stage from water-stage recorder, 3.35 feet at 2 p. m., June 14 (discharge, 4,890 second-feet); minimum discharge not known.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued.

Diversions.—There are court decrees for the diversion of 274 second-feet of water from Gunnison River between this station and the forks at Almont.

Regulation.—None.

Accuracy.—Stage-discharge relation shifted during year; affected by ice. Rating curve fairly well defined between 400 and 6,000 second-feet. Operation of water-stage recorder fairly satisfactory until August 15, when diaphragm bulb became full of silt. Daily discharge ascertained by applying to rating table daily gage height determined by inspecting gage-height graph; discharge after August 15 estimated as sum of discharge of East and Taylor rivers at Almont. Records good, except those for August and September, which are fair.

Discharge measurements of Gunnison River near Gunnison, Colo., during the year ending Sept. 30, 1916.

[Made by W. R. King.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 28	1.98	2,300
June 20	3.20	4,610
July 20	1.15	1,400

Daily discharge, in second-feet, of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		1,990	3,320	3,160	1,450	16		2,520	4,530	1,850	
2		1,990	3,320	3,000	1,580	17		2,360	4,620	1,640	
3		1,920	3,400	2,920	1,520	18		2,130	4,530	1,580	
4		2,130	3,560	2,680	1,450	19		2,200	4,530	1,520	
5		2,600	3,640	2,600	1,330	20		2,280	4,530	1,450	
6		2,680	3,560	2,600	1,330	21		2,200	4,170	1,390	
7		3,160	3,480	2,440	1,220	22		2,200	3,900	1,330	
8		3,400	3,400	2,440	1,220	23		2,130	3,560	1,280	
9		3,730	3,640	2,520	1,160	24		1,990	3,400	1,250	
10		3,990	4,080	2,600	1,220	25		2,130	3,240	1,220	
11		3,990	4,170	2,280	1,110	26		2,200	3,160	1,280	
12		3,820	4,260	2,060	960	27	1,810	2,200	3,160	1,220	
13		3,730	4,530	2,060	1,060	28	2,240	2,280	3,240	1,390	
14		3,240	4,620	1,990	1,220	29	2,550	2,440	3,240	1,390	
15		2,760	4,530	1,850		30	2,160	2,840	3,240	1,330	
						31		3,080		1,390	

Note.—Discharge estimated by hydrographic comparison with sum of records of flow of East and Taylor rivers as follows: Aug. 15–31, 730 second-feet; Sept. 1–30, 585 second-feet. Shifting-control method used Apr. 27 to June 9.

Monthly discharge of Gunnison River near Gunnison, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 27–30	2,550	1,810	2,190	17,400
May	3,990	1,920	2,660	164,000
June	4,620	3,160	3,820	227,000
July	3,160	1,220	1,930	119,000
August	1,580		[a] 975	60,000
September			[a] 535	31,800
The period				619,000

[a] Estimated.

EAST RIVER AT ALMONT, COLO.

Location.—In sec. 22, T. 51 N., R. 1 E., at highway bridge at Almont, in Gunnison County, 100 feet above junction of East and Taylor rivers.

Drainage area.—295 square miles (measured on map in Forest atlas).

Records available.—July 27, 1910, to September 30, 1916. From April 15 to October 8, 1905, a station was maintained at this point, gage being referred to different datum.

Gage.—Vertical staff on downstream side of right abutment; read by Sam Ogden.

Discharge measurements.—Made from two-span bridge.

Channel and control.—Bed composed of small boulders and coarse gravel. Control shifts slightly at ordinary stages.

Extremes of discharge.—Maximum stage recorded during year, 3.80 feet at 6 a. m. June 17 (discharge, 3,220 second-feet); minimum discharge occurred during winter.

Ice.—Stage-discharge relation affected by ice during winter; data insufficient to determine winter flow.

Diversions.—There are court decrees for diversion of 78 second-feet from East River.

Regulation.—

Accuracy.—Stage-discharge relation fairly permanent; seriously affected by ice. Rating curve well-defined between 150 and 2,800 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Cooperation.—Gage-height record furnished by United States Reclamation Service.

Discharge measurements of East River at Almont, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 28	W. R. King	2.40	1,120	July 19	W. R. King	2.01	721
June 20	do	3.25	2,340	Sept. 3	B. T. Chase	1.30	215

Daily discharge, in second-feet, of East River at Almont, Colo., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	192	1,020	1,530	1,260	850	232
2	....	192	905	1,820	1,200	745	232
3	....	192	850	1,890	1,200	605	232
4	....	192	962	1,890	1,080	650	232
5	....	192	1,080	1,890	1,080	695	232
6	....	192	1,260	1,740	1,080	745	232
7	75	192	1,600	1,740	962	745	232
8	80	192	1,740	1,600	962	650	232
9	100	192	1,960	1,670	1,200	650	232
10	92	200	2,110	2,260	1,200	565	380
11	92	285	1,890	2,420	1,080	565	348
12	92	285	1,820	2,420	1,080	488	315
13	92	285	1,740	2,580	962	565	285
14	92	285	1,600	2,900	962	605	255
15	100	315	1,600	2,980	850	695	232
16	110	348	1,460	2,980	850	650	232
17	110	348	1,330	3,060	850	565	232
18	110	348	1,330	2,820	745	488	232
19	110	348	1,260	2,740	745	415	232
20	110	348	1,140	2,340	695	348	232
21	120	380	1,080	2,420	650	348	232
22	132	450	1,080	2,110	650	348	232
23	132	605	1,080	1,890	565	348	232
24	132	650	1,080	1,670	565	348	232
25	132	695	1,080	1,670	565	285	210
26	132	795	1,080	1,670	565	285	192
27	132	962	1,080	1,670	525	285	192
28	132	1,080	1,200	1,670	605	255	192
29	132	1,200	1,260	1,530	695	232	192
30	132	1,080	1,400	1,400	1,020	232	192
31	132	....	1,460	....	962	232	....

Monthly discharge of East River at Almont, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 7-31	132	75	112	5,550
April	1,200	192	434	25,800
May	2,110	850	1,340	82,400
June	3,060	1,400	2,100	125,000
July	1,260	525	884	54,400
August	850	232	499	30,700
September	380	192	239	14,200
The period	....	....	....	338,000

UNCOMPAHGRE RIVER AT OURAY, COLO.

Location.—In sec. 31, T. 44 N., R. 7 W., near highway bridge half a mile south of Ouray, in Ouray County. Nearest tributary, Canyon Creek, enters 150 feet below; nearest tributary above is Bear Creek.

Drainage area.—44 square miles (measured on topographic map).

Records available.—January 25, 1911, to September 30, 1916. From January 7 to March 17, 1908, records were kept at dam of Ouray Electric Light & Power Co., 1 mile south of present station, and were furnished through courtesy of Wheeler & Whinnerah.

Gage.—Vertical staff attached to rock cliff at left side of river 150 feet above mouth of Canyon Creek. In addition to river gage a vertical staff gage was installed February 25, 1916, near downstream end of covered wooden flume in tailrace just below power house of the Ouray Electric Light & Power Co. The river and flume gages are read at as nearly the same time as possible by T. J. Watkins.

Discharge measurements.—Made from footbridge at gage, or by wading. Measurements of diversion through power house are made from a footbridge across tailrace a short distance below flume.

Channel and control.—Bed composed of small boulders; rough and shifting. Control short distance downstream, will shift somewhat after high water. Station is in box canyon with high vertical walls.

Extremes of discharge.—Maximum stage recorded during year, 3.20 feet during nights of June 11 and 13 (discharge, 638 second-feet; no diversion through power plant); minimum stage estimated at 0.00 foot on January 31 and February 1 (discharge, 0.5 second-foot; diversion through power plant not included).

Ice.—Stage-discharge relation not affected by ice, as warm springs keep the stream open.

Diversions.—The Ouray Electric Light & Power Co. diverts approximately 16 second-feet of water 2 miles above station and returns it to the river a short distance below. No other diversions above station.

Regulation.—None.

Accuracy.—Stage-discharge relation for river gage not permanent; shifts occasionally. Rating curve fairly well defined below 700 second-feet Gage read to hundredths once daily. Discharge ascertained by applying gage height to rating table; indirect method for shifting control used April 28 to June 24 and September 27–30.

Stage-discharge relation for tailrace gage practically permanent. Rating curve well defined. Gage read to half-tenths once daily. Discharge ascertained by applying gage height to rating table.

Records prior to March 1, 1916, do not include diversion through power plant. Records beginning March 1 show total flow of river, the discharge through the power plant being added to that past the river gage.

Records good except those for spring months which are only fair owing to the possible error due to diurnal fluctuation caused by alternate melting and freezing.

Discharge measurements of Uncompahgre River at Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15	W. R. King	0.30	4.8	June 6	T. J. Watkins	2.15	325
Jan. 9	T. J. Watkins	.15	1.8	15	.....do	2.56	362
Feb. 25	.....do	.04	1.0	Aug. 4	.....do	1.62	107
Mar. 17	.....do	.99	42.8	24	.....do	1.26	65
May 19	.....do	1.60	131				

Note.—The above measurements do not include the diversion through the power house.

Discharge measurements of power-house flume at Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 25	T. J. Watkins	1.60	17.0	May 19	T. J. Watkins	1.55	15.5
Mar. 17	.....do	1.55	15.5	Sept. 19	Robert Follansbee	.20	[a] .3

[a] Estimated.

Daily discharge, in second-feet, of Uncompahgre River at Ouray, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	3.0	8.0	1.8	0.5	17.6	46	85	335	187	92	58
2	15	3.0	6.0	1.8	.7	17.8	48	74	346	160	99	58
3	14	3.0	6.0	2.1	.9	17.8	36	64	412	169	106	58
4	11	3.0	6.0	2.1	.9	17.8	36	88	345	169	106	58
5	8.0	3.0	7.0	1.3	1.3	17.8	43	119	345	169	106	58
6	8.0	3.0	8.0	.7	1.1	17.8	43	138	367	169	106	48
7	8.0	8.0	6.0	.7	.9	18.0	46	199	448	159	106	48
8	8.0	7.0	5.0	.9	2.4	19.7	48	201	422	159	106	48
9	8.0	5.0	4.2	.9	.9	22	48	268	451	150	106	48
10	8.0	4.6	4.2	1.1	.9	25	51	299	543	140	106	58
11	8.0	3.0	3.0	.9	.9	28	53	302	555	131	92	58
12	8.0	1.3	2.7	.7	.9	29	55	290	527	131	92	58
13	26	1.3	2.4	.7	.9	30	51	228	503	122	92	58
14	29	2.1	1.8	6.5	.9	30	51	199	440	122	92	58
15	30	5.0	1.5	3.8	.9	32	49	136	437	122	93	58
16	11	4.2	1.5	.9	.9	32	57	136	397	122	86	58
17	8.0	3.0	1.3	.9	1.1	31	61	119	393	114	86	58
18	7.0	4.6	1.3	.7	1.1	45	65	127	373	106	80	58
19	7.0	6.0	1.3	.7	1.1	45	69	145	370	92	80	64
20	6.0	8.0	1.3	.9	1.1	45	73	145	367	92	80	68
21	6.0	10	1.3	.9	1.5	54	77	145	363	92	75	68
22	6.0	9.0	1.3	.9	1.8	62	94	136	299	86	75	62
23	5.0	9.0	1.1	.9	26	46	84	178	241	86	64	58
24	5.0	8.0	1.1	.9	15	46	80	204	252	86	64	56
25	5.0	1.8	1.1	.9	.9	36	100	206	236	86	58	52
26	4.2	3.0	1.1	.7	.9	35	120	221	236	80	58	48
27	4.2	4.6	1.1	.7	.9	36	140	199	211	92	58	55
28	3.8	7.0	1.3	.7	.9	36	162	226	211	96	48	54
29	3.4	7.0	1.3	.7	.9	48	126	229	211	96	48	53
30	3.0	8.0	1.5	.7	......	38	72	258	187	96	40	50
31	3.0	......	1.5	.5	......	36	......	358	......	106	48	......

NOTE.—From Oct. 1 to Feb. 29, the record shows the flow past the river gage at the time when gage was read. From Mar. 1 to Sept. 30, the record shows the total flow of river, the discharge through power plant having been added to that past the river gage. See "Accuracy" in station description.

Monthly discharge of Uncompahgre River at Ouray, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	30	3.0	9.41	579
November	10	1.3	4.95	295
December	8.0	1.1	2.97	183
January	6.5	.5	1.25	76.9
February	26	.5	2.38	137
March	62	17.6	32.6	2,000
April	162	36	69.5	4,140
May	358	64	184	11,300
June	555	187	361	21,500
July	187	80	122	7,500
August	106	40	82.2	5,050
September	68	48	56.4	3,360

NOTE.—Diversion through power plant not included in above record from October to February. Diversion included from March to September. See "Accuracy" in station description.

UNCOMPAHGRE RIVER BELOW OURAY, COLO.

Location.—In sec. 30, T. 44 N., R. 7 W. New Mexico principal meridian, near lowest bridge in Ouray, Ouray County, one-third mile below railroad station. Below all tributaries in Ouray.

Drainage area.—76 square miles (measured on topographic maps).

Records available.—May 12, 1913, to September 30, 1916.

Gage.—Vertical staff attached to rock cliff 500 feet above bridge; used since March 22, 1916; read by T. J. Watkins. Original gage, a vertical staff attached to downstream side of right bridge abutment, was used prior to March 22, 1916.

Discharge measurements.—Made from single span bridge, or by wading nearby.

Channel and control.—Bed composed of coarse gravel and small boulders; shifts during high water. Control not well defined. Banks not subject to overflow except at extreme high-water stage of 6.5 feet.

Extremes of discharge.—Maximum stage recorded during year, 4.10 feet at 7.40 p. m. June 9 (discharge, 1,100 second-feet); minimum stage, 1.96 feet at 8.40 a. m. Jan. 28, caused by snow slides (discharge, 18 second-feet).

Ice.—Stage-discharge relation not affected by ice. Warm springs keep the river from freezing.

Diversions.—All diverted water returned to river above station except 5.2 second-feet from Oak Creek.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts between narrow limits. Rating curve used prior to March 22 fairly well defined below 1,200 second-feet; curve used after March 22 well defined below 200 second-feet and fairly well defined between 200 and 1,200 second-feet. Gage read to hundredths once daily except for occasional short periods when it is read twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for spring months which are fair owing to possible error due to diurnal fluctuation from alternate melting and freezing.

Discharge measurements of Uncompahgre River below Ouray, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height in feet.		Discharge.	Date.	Made by—	Gage height in feet.		Discharge.
		Original gage.	Gage installed Mar. 22, 1916.				Original gage.	Gage installed Mar. 22, 1916.	
				Sec.-ft.					*Sec.-ft.*
Nov. 15	W. R. King.....	2.11	....	27.2	June 6	T. J. Watkins....	3.58	3.48	515
Jan. 4	T. J. Watkins....	2.15	....	29.6	15	.....do..........	....	3.60	695
Feb. 26	.....do..........	2.12	....	30.7	July 26	E. H. Swett.....	3.00	2.60	192
Mar. 17	.....do..........	2.47	....	74	Aug. 4	T. J. Watkins...	3.10	2.80	298
May 19	.....do..........	2.90	2.54	194	23	.....do..........	2.70	2.10	105

Daily discharge, in second-feet, of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	51	31	32	28	28	32	56	142	658	402	258	91
2	51	31	29	28	28	33	58	155	650	402	264	91
3	49	31	29	29	29	33	45	122	690	402	290	91
4	44	31	29	29	29	33	45	107	860	402	296	91
5	42	31	29	29	31	35	56	125	533	402	293	91
6	41	30	31	30	21	35	54	207	592	397	290	75
7	41	35	29	26	29	35	45	406	592	397	286	75
8	41	33	28	29	32	38	39	397	910	379	283	75
9	39	32	26	28	28	42	54	384	931	388	280	75
10	39	32	26	31	28	47	58	520	1,010	388	220	96
11	38	28	25	29	30	53	80	514	820	384	217	91
12	38	21	25	28	30	53	80	402	1,050	374	214	71
13	38	22	26	29	27	58	61	249	1,070	374	212	71
14	38	26	28	31	30	63	58	249	1,040	374	210	71
15	38	28	28	31	27	66	61	249	784	384	207	71
16	37	26	28	28	30	71	80	189	1,040	379	204	71
17	35	29	28	28	30	69	80	142	920	379	160	71
18	33	29	28	28	33	69	95	155	766	370	160	71
19	33	34	28	19	35	69	110	217	757	304	160	71
20	33	34	28	28	32	72	125	198	706	237	160	69
21	35	36	28	28	34	75	140	198	698	170	160	69
22	35	34	28	28	36	77	156	198	457	191	160	71
23	35	34	26	28	34	65	155	217	457	170	110	71
24	35	34	26	27	32	65	156	222	457	170	110	65
25	35	28	26	27	31	46	197	252	457	191	110	59
26	32	29	26	27	31	46	238	283	457	191	96	54
27	32	32	26	28	31	43	279	290	457	195	96	56
28	32	34	26	18	31	46	321	290	457	200	96	56
29	32	34	28	23	31	58	238	397	402	204	91	54
30	32	34	28	27	....	43	155	552	402	210	82	54
31	31	....	28	27	....	46	....	546	....	252	91	....

NOTE.—Shifting-control method used to determine discharge Oct. 1 to Nov. 10, Jan. 21 to Mar. 21, and May 30 to Aug. 16. Discharge July 19-20 estimated, as gage heights were in error.

Monthly discharge of Uncompahgre River below Ouray, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	51	31	37.6	2,310
November	36	21	30.7	1,830
December	32	25	27.6	1,700
January	31	18	27.5	1,690
February	36	21	30.3	1,740
March	77	32	52.1	3,200
April	321	39	112	6,690
May	552	107	277	17,000
June	1,070	402	703	41,800
July	402	170	312	19,200
August	296	82	189	11,600
September	96	54	72.9	4,340
The year	1,070	18	156	113,000

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

Location.—In sec. 31, T. 49 N., R. 9 W., at highway bridge one-fourth mile west of Montrose, in Montrose County. Nearest large tributary, Happy Canyon Creek, enters about 2 miles below.

Drainage area.—565 square miles.

Records available.—April 22, 1903, to September 30, 1916.

Gage.—Vertical staff attached to bridge; read by L. R. Allen.

Discharge measurements.—Made from bridge.

Channel and control.—Bed composed of sand and gravel; shifts occasionally.

Extremes of discharge.—Maximum stage recorded during year, 5.42 feet on August 14 (discharge, 1,200 second-feet); minimum discharge probably occurred during the winter.

Ice.—Ice forms along the banks during winter, but river is not frozen over. Observations discontinued during winter.

Diversions.—The water of Uncompahgre River is so overappropriated that the United States Reclamation Service has constructed a tunnel and canal to divert 1,300 second-feet from Gunnison River into the Uncompahgre above Uncompahgre.

Accuracy.—Stage-discharge relation not permanent; shifts occasionally; somewhat affected by ice which forms along banks. Rating curve fairly well defined below 1,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except those for June and July, which are only fair owing to shifting of control.

Cooperation.—Field data furnished by the United States Reclamation Service.

Discharge measurements of Uncompahgre River at Montrose, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	W. T. Ferguson	2.40	36.9	July 13	E. H. Swett	4.08	403
Apr. 5	E. H. Swett	2.60	54	Aug. 4	Swett and Chase	4.85	881
21	.....do	3.33	200	Sept. 5	B. T. Chase	3.85	215
June 12	.....do	4.28	512	19	.....do	3.05	143
13	.....do	5.05	820				

Daily discharge, in second-feet, of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	8	70		188	264	320	196	232
2	124	8	78		136	355	351	481	202
3	367	9	78		114	463	328	375	248
4	232	13	85		114	392	355	703	217
5	208	13	114	54	202	405	324	500	238
6	169	13	85		271	486	254	703	153
7	94	13	85		316	477	523	832	124
8	73	13	82		264	547	328	532	124
9	74	13	78		367	575	211	454	180
10	78	13	85		396	518	673	396	343
11	64	13	78		335	248	458	248	107
12	52	13	70		258	388	504	281	202
13	46	12	70		238	728	295	316	174
14	29	13	57		238	594	264	1,200	180
15	78	13	57		238	384	267	463	148
16	50	42		136	281	401	405	509	136
17	46	42		148	298	379	347	509	114
18	40	46		136	298	422	331	355	114
19	188	52		94	375	427	281	281	114
20	33	49		52	396	427	284	217	107
21	32	57		217	375	384	254	174	124
22	22	57		226	418	316	258	136	114
23	29	57		238	335	339	261	217	114
24	29	57		305	284	409	375	202	114
25	29	57		248	328	371	350	238	99
26	20	37		238	298	401	542	217	94
27	12	57		169	298	445	547	161	114
28	42	57		217	343	396	392	169	94
29	13	46		375	335	703	316	217	70
30	8	57		202	375	355	585	248	57
31	8				440		405	217	

Note.—Discharge, June 4 to Aug. 2, determined by shifting-control method.

Monthly discharge of Uncompahgre River at Montrose, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	367	8	77.8	4,790
November	57	8	31.7	1,890
December 1-15	114	57	78.1	2,320
April 16-30	375	52	200	5,950
May	440	114	295	18,100
June	728	248	433	25,800
July	673	211	368	22,600
August	1,200	136	379	23,300
September	343	57	148	8,810

UNCOMPAHGRE RIVER NEAR DELTA, COLO.

Location.—In T. 15 S., on line between Rs. 95 and 96 W., at highway bridge 2 miles south of Delta, in Delta County. No tributaries below station and none for several miles above.

Drainage area.—1,130 square miles.

Records available.—April 29, 1903, to September 30, 1916.

Gage.—Vertical staff read by Mrs. W. J. Lance. Original gage was at a highway bridge one-fourth mile above Denver & Rio Grande Railroad bridge; moved to latter bridge November 17, 1903; replaced by an inclined gage installed near bridge April 21, 1904, which was used until November, 1906, when a staff gage was placed at present site. April 16, 1910, a new gage was installed at slightly different datum. No determined relation between gages at the various sites.

Discharge measurements.—Made from bridge.

Channel and control.—Bed composed of silt and gravel. Banks not subject to overflow. Control shifts at intervals.

Extremes of discharge.—Maximum stage recorded during year, 3.8 feet at 5.30 p. m. August 14 (discharge, 1,310 second-feet); minimum discharge occurred during winter.

Ice.—Ice forms along banks and slush ice frequently occurs, but the stage-discharge relation is probably not materially affected thereby. Observations discontinued during winter.

Diversions.—Ditches above station divert the normal flow during irrigation season; records represent largely return seepage water.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; shifts considerably; affected somewhat by ice which forms along banks. Rating curves not well-defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Cooperation.—Field data furnished by United States Reclamation Service, which maintains the station.

Discharge measurements of Uncompahgre River near Delta, Colo., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	W. T. Ferguson	1.40	169	June 22	E. H. Swett	1.90	232
Apr. 25	E. H. Swett	1.94	282	July 31	.....do	2.58	477
May 4	.....do	1.21	83	Sept. 12	B. T. Chase	1.55	149
19	.....do	1.55	179				

Daily discharge, in second-feet, of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	191	98	206	....	338	73	92	227	148
2	220	152	206	....	124	136	64	457	136
3	345	140	206	....	92	124	69	367	148
4	365	129	206	....	82	188	56	457	148
5	285	140	206	....	82	161	82	506	136
6	268	140	206	....	202	182	40	642	161
7	220	152	206	....	330	224	40	730	113
8	220	178	191	....	397	188	82	506	113
9	285	164	178	....	424	117	88	506	136
10	164	191	152	....	452	233	326	354	402
11	164	191	191	....	420	161	218	227	346
12	191	152	191	....	310	141	88	202	141
13	206	164	191	....	302	166	213	202	218
14	206	164	191	....	250	410	77	1,210	202
15	152	191	191	....	180	166	82	410	188
16	250	191	....	48	146	211	113	559	161
17	220	220	....	82	141	96	124	481	136
18	191	220	....	161	146	102	82	402	124
19	164	220	....	124	153	174	82	326	136
20	140	220	....	64	188	224	77	244	136
21	129	220	....	73	338	166	64	161	181
22	140	220	....	113	334	166	64	131	136
23	140	191	....	188	268	102	73	136	136
24	140	164	....	306	244	174	73	148	174
25	118	178	....	287	371	161	73	136	136
26	98	191	....	306	233	174	367	113	156
27	108	191	....	196	161	174	306	102	141
28	118	191	....	218	188	148	306	92	156
29	118	164	....	148	188	136	218	109	136
30	118	178	....	367	188	148	346	174	92
31	118	....	....	....	148	....	410	218	....

NOTE.—Discharge, May 7 to Sept. 30, determined by shifting-control method.

Monthly discharge of Uncompahgre River near Delta, Colo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	365	98	187	11,500
November	220	98	177	10,500
December 1-15	206	152	195	5,800
April 16-30	367	48	179	5,330
May	452	82	239	14,700
June	410	73	168	10,000
July	410	40	142	8,730
August	1,210	92	340	20,900
September	402	92	161	9,580

MILL CREEK NEAR MOAB, UTAH.

LOCATION.—In sec. 8, T. 26 S., R. 22 E., about a quarter of a mile above the dam, about half a mile below mouth of Dry Fork, and about three-quarters of a mile above power plant of Moab Light & Power Co.; 1½ miles above confluence with Pack (Deep) Creek, and 2 miles southeast of Moab, Grand County.

DRAINAGE AREA.—76 square miles.

RECORDS AVAILABLE.—October 24, 1914, to September 30, 1916.

GAGE.—Vertical staff on left bank; read by Bruce Cox and Peter Shumway, operators at the plant.

DISCHARGE MEASUREMENTS.—Made by wading in the vicinity of the gage.

CHANNEL AND CONTROL.—Stream bed rocky and banks high. Control is a rock ledge a few feet below the gage and probably is fairly permanent. Stage of zero flow about —0.2 foot.

Extremes of discharge.—Maximum stage recorded during year, 2.3 feet at 6.30 p. m. August 12 (discharge estimated by prolonging rating curve, 235 second-feet); minimum stage recorded, 0.56 foot in September (discharge 8.8 second-feet).

1915–1916: Maximum stage recorded, that of this year; minimum stage recorded, 0.52 foot September 11–23, 1915 (discharge 7.4 second-feet).

Ice.—Stage-discharge relation affected at times by ice. No records of stage were kept during December and January.

Diversions.—Above practically all diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between 5 and 60 second-feet. Gage not read regularly. Gage readings on many days not a true index of flow because of extreme diurnal fluctuation. Monthly mean discharge not computed.

Discharge measurements of Mill Creek near Moab, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 19	L. W. Jordan	0.55	8.1
Feb. 28	A. B. Purton	.60	10.6
June 14	W. E. Dickinson	.98	38.6

Daily discharge, in second-feet, of Mill Creek near Moab, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	June.	July.	Aug.	Sept.
1		9				24	30	10
2	8					27		
3						22	22	10
4		9				24		10
5		9					42	
6		50		11		22		11
7		50				22	30	
8	8	12				24		9
9	8	9				25	24	
10						54		13
11	8					25	18	
12							100	12
13		7		13		19	44	11
14	8				40	20		
15						24		9
16	8	14				60	24	
17						25		9
18								
19						16	16	11
20	9			15				
21	9	11				16	15	
22		11				15		9
23					32		13	
24		9			32	14		11
25					30		13	
26					30		13	11
27	9			15	30	40		
28			11		30	60	11	11
29					30	32		11
30					30	28	14	
31						50		

Note.—Discharge estimated from observer's notes because of daily fluctuation, Nov. 6, 7, July 16, 28, 31, and Aug. 12.

SAN JUAN RIVER BASIN.

SAN JUAN RIVER NEAR BLUFF, UTAH.

Location.—In sec. 7, T. 42 S., R. 19 E., at the suspension bridge about a quarter of a mile from Spencer's trading post at Goodridge, a quarter of a mile below Gypsum Creek, 6 miles below Lime Creek, and 25 miles southwest of Bluff, San Juan County.

Drainage area.—24,000 square miles.

Records available.—October 30, 1914, to September 30, 1916.

Gage.—Chain gage on right bank about 150 feet above the suspension bridge read by A. H. Spencer. Gage was moved upstream about 50 feet and datum changed March 4, 1916.

Discharge measurements.—Made from a cable 200 feet below the bridge.

Channel and control.—Bed composed of shifting sand. Stream confined between rock walls; one channel only. Stage of zero flow is about −2 feet. Control probably a rock ledge three-eighths mile below gage.

Extremes of discharge.—Maximum stage recorded during year 12.8 feet at noon March 24 (discharge 16,200 second-feet); minimum stage 0.05 foot at 9 a. m. December 28 (discharge 388 second-feet).

1915–1916: Maximum stage recorded, 15.06 feet at 7 p. m. July 28, 1915 (discharge 26,400 second-feet); minimum stage, 0.05 foot at 10 a. m. September 24, 1915 (discharge 380 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—No diversions between Bluff and the gaging station. Considerable water is diverted farther up the stream.

Regulation.—Regulation of the stream probably does not affect the diurnal flow at the gage.

Accuracy.—Stage-discharge relation permanent; not seriously affected by ice. Rating curve well defined for range in gage heights. Gage read to half tenths once daily, except during November, December, and January, when it was read at least every alternate day. Daily discharge determined by applying daily gage height to rating table except for days when gage was not read and when stage-discharge relation was affected by ice for which it was interpolated. Records good.

Discharge measurements of San Juan River near Bluff, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	L. W. Jordan..........	0.79	723	Mar. 4	A. B. Purton...........	[a]4.15	1,490
24	.....do....................	.74	716	June 19	W. E. Dickinson.......	[a]10.46	11,100

[a] Gage height read on new gage established Mar. 4, 1916.

Daily discharge, in second-feet, of San Juan River, near Bluff, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,960	576	601	550	1,060	1,830	7,130	12,000	10,200	6,450	8,030	2,490
2	1,540	564	601	600	1,310	2,190	6,860	12,000	9,750	6,280	9,550	2,290
3	1,540	552	654	585	1,570	1,380	6,110	8,780	8,970	6,110	14,500	2,100
4	1,380	589	707	575	1,830	1,500	6,280	7,920	9,750	6,110	13,300	1,970
5	1,310	626	780	530	1,830	1,340	6,790	6,960	9,950	5,630	10,400	1,880
6	1,380	552	854	760	1,340	1,580	9,750	7,810	10,200	5,470	8,300	1,880
7	1,190	552	809	840	2,390	3,020	7,490	9,950	11,500	4,700	11,400	1,830
8	1,620	707	764	920	854	2,800	5,890	10,800	10,200	4,780	11,200	1,740
9	1,020	666	707	850	1,190	1,830	5,470	12,800	11,400	4,410	8,400	2,060
10	1,090	626	680	1,040	1,120	2,800	4,850	14,000	11,000	5,790	7,310	2,010
11	1,020	710	652	1,230	1,120	4,410	5,310	14,900	12,200	6,960	8,210	5,550
12	886	793	722	1,230	1,050	5,790	6,450	15,500	13,300	7,670	8,970	5,790
13	886	778	793	865	1,270	6,110	8,030	15,000	14,400	6,620	8,970	4,270
14	764	764	793	505	1,190	7,490	7,670	13,000	13,700	6,880	8,210	3,870
15	764	658	793	550	1,050	8,400	7,850	14,000	13,500	6,110	9,550	3,610
16	764	552	778	485	984	6,790	6,450	9,950	13,000	5,790	8,590	3,370
17	764	576	764	955	1,190	6,110	5,950	8,210	12,400	5,790	9,350	2,910
18	764	601	738	1,380	1,500	7,130	6,790	7,490	12,300	5,310	7,850	2,590
19	707	682	707	3,610	1,580	6,620	7,850	6,790	11,200	4,920	7,130	2,490
20	652	764	626	2,100	1,540	8,210	8,400	6,330	11,200	4,270	7,490	2,390
21	652	707	545	2,010	1,660	8,210	6,790	6,620	11,400	3,870	5,470	2,390
22	601	735	464	1,460	1,660	9,550	6,530	7,490	10,600	3,370	4,550	2,390
23	652	721	474	920	1,660	15,800	6,450	7,130	9,550	3,250	3,490	2,190
24	707	707	485	985	1,500	16,200	7,940	6,620	8,880	2,910	3,130	2,060
25	735	824	464	1,050	1,120	13,300	9,550	6,280	8,030	2,800	2,910	2,030
26	679	794	444	1,380	1,420	8,500	9,950	5,470	7,850	3,020	2,690	2,010
27	707	764	416	1,700	1,340	6,450	10,800	5,950	7,490	3,020	2,390	1,920
28	679	652	388	5,790	1,530	5,630	10,600	6,450	7,130	5,150	2,390	1,920
29	601	626	470	2,590	1,740	5,950	10,200	6,960	7,310	5,790	2,290	1,830
30	552	601	552	1,690	....	6,960	11,000	8,030	7,130	4,480	2,490	1,830
31	601	....	507	795	....	8,590	....	8,780	....	6,280	2,390	....

NOTE.—Discharge Feb. 1–3, interpolated because of ice; for Nov., Dec., and Jan., interpolated for days when gage was not read.

Monthly discharge of San Juan River, near Bluff, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,960	552	941	57,900
November	824	552	667	39,700
December	793	388	637	39,200
January	5,790	505	1,310	80,600
February	2,390	854	1,400	80,500
March	16,200	1,340	6,210	382,000
April	11,000	4,850	7,570	450,000
May	15,500	5,470	9,340	574,000
June	14,400	7,130	10,500	625,000
July	7,670	2,800	5,160	317,000
August	14,500	2,290	7,120	438,000
September	5,790	1,740	2,590	154,000
The year	16,200	388	4,460	3,240,000

NORTH FORK OF NORTH MONTEZUMA CREEK AT MONTICELLO, UTAH.

LOCATION.—In the NE. ¼ sec. 35, T. 33 S., R. 23 E., 200 yards below the heading of Middle canal, 300 yards below the ranger's cabin, three-quarters of a mile west of Monticello, San Juan County, and a mile east of the boundary of the La Sal National Forest.

DRAINAGE AREA.—About 10.5 square miles.

RECORDS AVAILABLE.—June 4, 1914, to September 30, 1916.

GAGE.—Vertical staff on right bank; read by J. W. Palmer, forest ranger. Datum raised 1.50 feet on July 22, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

Channel and control.—Stream bed of gravel and boulders. Right bank high; left bank fairly high but may be overflowed. Control consists of boulders set in a trench at the head of a riffle about 10 feet below the gage. Stage of zero flow about 0.3 foot on March 1, 1916.

Extremes of discharge.—Maximum stage recorded during year, 1.06 feet April 10 and 11 (discharge not determined); minimum stage 0.04 foot July 21 and 22 (discharge not determined).

1914–1916: Maximum stage recorded 1.70 feet at 9.30 a. m. May 18, 1915 (discharge 54 second-feet); minimum stage recorded, that of this year.

Ice.—There is heavy snowfall, but stage-discharge relation does not seem to be greatly affected by ice. Observations discontinued during winter.

Diversion.—Middle canal diverts about 200 yards above the gage. During the winter only a small quantity of water is carried in this ditch and the rest wastes into the creek above the gaging station. The Wood high line and North canals also take water by means of a common diversion about a mile upstream. Water from the South Fork of Montezuma Creek is carried by means of the South canal and turned into the North Fork just above the heading of the Middle canal.

Regulation.—Flow affected by the diversions noted above.

Data inadequate for determination of discharge.

Discharge measurements of North Fork of North Montezuma Creek at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Foot.	*Sec.-ft.*
Mar. 1[a]	A. B. Purton	0.58	0.4
June 16	W. E. Dickinson	.11	.2

Daily gage height, in feet, of North Fork of North Montezuma Creek at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.58	0.90	0.30	0.14	0.12	0.42	0.20
2	.58	.92	.40	.16	.14	.44	.22
3	.58	.92	.20	.18	.12	.42	.18
4	.58	.92	.30	.18	.12	.40	.18
5	.58	.94	.40	.16	.14	.36	.20
6	.59	.94	.30	.16	.16	.40	.18
7	.59	.96	.20	.14	.18	.36	.20
8	.59	.98	.18	.12	.16	.32	.20
9	.60	1.04	.20	.12	.14	.32	.24
10	.60	1.06	.20	.14	.12	.30	.18
11	.60	1.06	.30	.14	.12	.30	.20
12	.62	1.00	.20	.14	.10	.30	.22
13	.62	.80	.28	.18	.10	.50	.22
14	.63	.78	.20	.16	.09	.50	.16
15	.63	.74	.30	.16	.09	.48	.22
16	.64	.72	.20	.18	.08	.44	.20
17	.63	.70	.22	.16	.07	.44	.16
18	.63	.70	.20	.14	.06	.42	.14
19	.64	.69	.14	.14	.06	.42	.12
20	.65	.69	.16	.16	.05	.24	.14
21	.65	.60	.16	.14	.04	.22	.16
22	.65	.58	.14	.14	.04	.20	.20
23	.65	.40	.12	.12	.10	.20	.22
24	.67	.30	.14	.10	.12	.19	.16
25	.68	.20	.16	.10	.16	.20	.12
26	.68	.20	.14	.10	.18	.20	.16
27	.68	.10	.16	.12	.18	.20	.12
28	.70	.20	.14	.12	.20	.22	.16
29	.74	.30	.16	.10	.30	.20	.14
30	.76	.30	.14	.12	.48	.22	.12
31	.80	....	.12	....	.45	.19	....

MIDDLE CANAL AT MONTICELLO, UTAH.

Location.—In the NE. ¼ sec. 35, T. 33 S., R. 23 E., 100 feet below the head of the canal, at the ranger station about three-quarters of a mile west of Monticello, San Juan County, and a mile east of the Forest boundary.

Records available.—May 24 to July 31, 1914; May 26 to August 31, 1915; April 1 to September 30, 1916.

Gage.—Vertical staff. Datum lowered 1.0 foot, May 26, 1915.

Discharge measurements.—Made from a footplank at the gage.

Channel and control.—Bed composed of sand and gravel. Control formed by a 2-inch plank with a Cippoletti weir notch set in the ditch just below the gage. Point of zero flow about 2.1 feet.

Extremes of discharge.—Maximum stage recorded during year 2.92 feet June 2 and 4 (discharge 13 second-feet); minimum stage recorded April 2 and September 25 (discharge less than 0.1 second-foot).

1914–1916: Maximum stage recorded 2.2 feet (3.2 feet referred to present datum) July 11, 1914 (discharge 23.6 second-feet).

Ice.—No records during winter. A small flow is probably maintained to supply domestic needs practically all the year.

Diversions.—Above all diversions. There is a wasteway just below the heading.

Regulation.—Flow regulated at waste gate.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve well defined between 0 and 14 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Middle canal diverts water from North Fork of North Montezuma Creek for irrigation and domestic use in and around Monticello. The water is not returned directly to the stream. Part of the water carried in the Middle canal is brought around from South Fork of North Montezuma Creek in South canal and emptied into North Fork just above the heading of Middle canal.

Discharge measurements of Middle canal at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21[a]	L. W. Jordan	2.22	0.6
Mar. 1[b]	A. B. Purton	2.20	.2
June 16	W. E. Dickinson	2.76	8.4

[a] No ice. Water apparently running freely under 2 feet of snow.
[b] Stage-discharge relation affected by snow in canal.

Daily discharge, in second-feet, of Middle canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		0.2	0.1	4.8	12	7.5	1.6	0.8
2			.1	4.8	13	7.0	1.7	.8
3			.2	5.2	12	6.6	1.6	.8
4			.2	5.7	13	6.1	1.1	.8
5			.4	6.1	12	5.7	.9	.8
6			.5	6.1	11	5.2	1.1	.9
7			.5	7.0	11	5.7	.9	1.0
8			.6	7.0	11	4.8	1.0	1.1
9			.7	8.0	10	4.8	1.0	1.7
10			1.1	9.4	9.9	4.5	.9	1.1
11			1.1	8.9	9.9	4.1	.9	1.1
12			1.4	6.1	9.4	3.8	.9	1.0
13			1.7	4.5	8.9	3.4	1.6	.9
14			2.6	6.1	8.9	3.4	1.6	.8
15			6.1	7.0	9.4	3.1	1.4	.7
16			9.4	8.4	9.9	3.8	1.1	.6
17			8.9	9.4	9.4	4.1	.9	.5
18			8.4	12	9.4	3.8	.7	.4
19			8.0	7.5	8.9	3.8	.6	.4
20			7.5	8.4	8.9	4.1	.6	.3
21	0.7		7.0	8.9	8.4	4.5	.7	.2
22			6.6	8.9	8.0	1.9	.8	.2
23			6.1	9.4	7.5	1.9	.8	.1
24			5.7	10	7.0	1.9	.7	.1
25			5.2	11	7.0	1.7	.8	.1
26			4.8	11	7.0	1.7	.8	.1
27			5.7	12	7.0	1.9	.8	.2
28			5.2	11	6.6	2.1	.7	.2
29			4.8	11	7.0	4.8	.8	.6
30			4.5	12	7.5	2.6	.8	1.6
31				11		1.6	.8	

Monthly discharge of Middle canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	9.4	0.1	3.84	228
May	12	4.5	8.34	513
June	13	6.6	9.36	557
July	7.5	1.6	3.93	242
August	1.7	.6	.987	60.6
September	1.7	.1	.663	39.5
The period				1,640

SOUTH CANAL AT MONTICELLO, UTAH.

Location.—In sec. 35, T. 33 S., R. 23 E., about 200 yards above point where canal empties into North Fork of North Montezuma Creek, 300 yards south of ranger station, 1½ miles below the head of the canal, and about three-quarters of a mile west of Monticello, San Juan County.

Records available.—May 24 to July 29, 1914; May 28 to August 31, 1915; May 12 to September 30, 1916.

Gage.—Vertical staff on left bank.

Channel and control.—Bed consists of earth and gravel. Control is Cippoletti weir notch in plank set in bed of canal just below gage. Stage of zero flow 1.63 feet.

Extremes of discharge.—Maximum stage recorded during year, 2.4 feet, June 3 (discharge 11 second-feet); minimum stage recorded, 1.70 feet, March 1 (flow estimated 0.15 second-foot).

1914–1916: Maximum stage recorded, 2.8 feet, July 10, 1914 (discharge 15.4 second-feet).

Ice.—The ditch freezes and fills with snow, but there is usually a small quantity of water running. Observations of stage discontinued during winter.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between 0 and 14 second-feet. Gage read daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Record good.

South canal is a feeder for Middle canal. Water is diverted from South Fork of North Montezuma Creek near the center of sec. 2, T. 34 S. R. 23 E., and emptied into North Fork of Montezuma Creek just above the heading of Middle canal in the NW. ¼ sec. 35, T. 33 S., R. 23 E.

Discharge measurements of South canal at Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 1[a]	A. B. Purton	1.70	0.15
June 16	W. E. Dickinson	2.16	4.2

[a] Discharge estimated; 2 feet of snow over 4-inch ice cover, but water was apparently flowing freely under ice.

Daily discharge, in second-feet, of South canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Mar.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	May.	June.	July.	Aug.	Sept.
1	0.1		9.0	2.2	1.5	0.7	16		3.3	3.3	2.7	1.9	5.4
2			10	2.5	1.7	.7	17		5.4	3.0	2.9	1.7	5.0
3			11	2.7	1.5	1.9	18		7.9	3.0	2.7	1.5	4.6
4			10	3.0	.7	5.4	19		5.4	2.7	2.6	1.5	4.6
5			9.6	3.3	.5	6.4	20		5.4	3.0	2.5	.8	3.7
6			9.0	3.7	.9	7.4	21		5.4	2.7	2.5	.7	3.3
7			8.5	3.7	.6	7.9	22		3.3	2.5	2.3	.6	3.0
8			7.9	1.9	.7	7.9	23		3.7	2.5	1.0	.6	2.7
9			7.9	1.9	.7	10.	24		4.1	2.2	1.2	.5	2.7
10			7.4	1.9	.6	7.9	25		5.0	1.9	1.4	.6	2.5
11			6.9	3.3	.6	7.9	26		4.6	1.9	1.5	.6	2.7
12		0.3	5.9	3.2	.6	7.4	27		5.4	2.2	1.7	.6	3.0
13		.3	5.0	3.0	2.5	6.9	28		5.9	2.2	5.4	.5	3.3
14		.4	4.6	2.9	2.5	6.4	29		6.4	1.9	5.4	.6	5.4
15		.6	4.1	2.7	1.9	5.9	30		7.4	2.2	1.9	.5	9.6
							31		7.9		1.5	.6	

Monthly discharge of South canal at Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 12–31	7.9	0.3	4.40	175
June	11	1.9	5.13	305
July	5.4	1.0	2.62	161
August	2.5	.5	1.01	62.1
September	10	.7	5.07	302

SPRING (VAGA) CREEK NEAR MONTICELLO, UTAH.

Location.—In the SE. ¼ sec. 7, T. 33 S., R. 23 E., at the Trujillo ranch, 40 feet below the head of Green canal and 8 miles northwest of Monticello, San Juan County.

Drainage area.—8.5 square miles.

Records available.—May 26 to August 25, 1914; April 6 to September 30, 1915; April 1 to August 31, 1916.

Gage.—Vertical staff on the right bank. Datum lowered 0.70 foot May 27, 1915. Read by Gusman Trujillo.

Discharge measurements.—Made by wading.

Channel and control.—Stream bed of gravel. Channel crooked and banks overgrown with grass and weeds. Control of rocks placed in a trench just below the gage. Stage of zero flow about 0.2 foot.

Extremes of discharge.—Maximum stage recorded during year, 1.50 feet at 4.30 p. m. July 22 and afternoons of July 31, August 1 and 2 (discharge 28 second-feet); minimum stage recorded, 0.15 foot, April 1 (no flow, water standing in pools).

1914–1916: Maximum discharge recorded, 33 second-feet, July 26, 1914.

Ice.—Ordinarily no flow during winter.

Diversions.—Above all diversions except Green canal and Davenport & Campbell canal.

Regulation.—Affected by the operation of the two ditches.

Accuracy.—Stage-discharge relation probably permanent during year. Rating curve fairly well defined between 0 and 10 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Spring (Vaga) Creek near Monticello, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 21	L. W. Jordan	0.29	0.2
June 16	W. E. Dickinson	.91	9.1

Daily discharge, in second-feet, of Spring (Vaga) Creek near Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	0.0	6	18	3	17	16	0.2	12	10	3	9
2	.0	4	18	2	17	17	.6	9	14	2	9
3	.0	8	18	.9	10	18	.6	8	12	.9	7
4	.1	10	18	3	10	19	2	11	14	.9	7
5	.1	12	18	2	9	20	.1	8	12	.9	6
6	.0	14	18	2	10	21	.1	7	10	.9	5
7	.1	12	17	2	9	22	.0	10	7	10	5
8	.1	18	22	3	9	23	.6	10	7	4	5
9	.1	20	20	7	9	24	.6	8	6	.9	5
10	.1	12	18	3	9	25	2	12	6	9	4
11	.6	10	18	3	9	26	2	12	4	4	3
12	.2	11	18	3	10	27	2	12	3	9	3
13	.1	10	14	3	11	28	4	12	4	3	2
14	.6	8	14	3	10	29	4	15	2	3	6
15	.2	8	17	3	9	30	4	18	4	3	.2
						31		18		17	.2

Monthly discharge of Spring (Vaga) Creek near Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	4	0	0.837	49.8
May	18	4	11.1	682
June	22	2	12.7	756
July	17	.9	3.69	227
August	17	.2	7.56	465
The period				2,180

GREEN CANAL NEAR MONTICELLO, UTAH.

Location.—In sec. 7, T. 33 S., R. 23 E., 50 feet below the head of the canal, near Trujillo ranch, and 8 miles northwest of Monticello, San Juan County.

Records available.—May 26 to August 21, 1914; June 8 to Augurt 16, 1915; April 1 to September 30, 1916.

Gage.—Vertical staff set at new datum in 1915.

Discharge measurements.—Made by wading.

Channel and control.—Earth section. Stage of zero flow about 1.9 feet.

Extremes of discharge.—Maximum stage recorded during year, 2.8 feet, May 20 and 31 (discharge 3.7 second-feet).

1914–1916: Maximum stage not recorded, as water was over gage on June 11, 1915; mean flow for the day estimated at 5 second-feet.

Ice.—No information.

Diversions.—Above all diversions.

Regulation.—By head gate at point of diversion.

Accuracy.—Stage-discharge relation probably permanent. Rating curve well defined for range in stage during period. Gage read to half tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Green canal diverts water from Spring Creek in the SW. ¼ sec. 7, T. 33 S., R. 23 E., for irrigation use on Green ranch. The water is not returned directly to the creek.

The following discharge measurement was made by W. E. Dickinson:

June 16, 1916: Gage height, 2.60 feet; discharge, 2.2 second-feet.

Daily discharge, in second-feet, of Green canal near Monticello, Utah, for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.
1		0.0	1.9	0.5	0.9
2		.0	1.9	.5	.5
3		.5	1.4	.4	.5
4		.7	.9	.4	.4
5		.3	.5	.5	.4
6		.3	1.4	.1	.5
7		.3	.9	.2	.4
8		.3	.9	.1	.4
9		.9	.7	1.4	.4
10		.9	.7	1.1	.5
11		.3	.5	.9	.4
12		.5	.5	1.1	.4
13		.3	.5	1.1	
14		.5	.5	.7	
15		.3	.7	.4	
16		0.3	2.5	1.1	
17		.4	2.2	.7	
18		.7	1.4	.0	
19		.9	.5	.0	
20		3.3	.5	.0	
21		1.9	.2	.0	
22	0.9	2.5	.1	.0	
23	1.2	1.9	.0	.0	
24	.9	2.5	.0	.9	
25	.9	2.5	.0	.9	
26	1.1	2.5	.7	1.1	
27	1.6	2.5	.4	2.2	
28	1.9	2.5	.3	.9	
29	1.9	1.9	.4	.5	
30	.0	2.2	.7	.5	
31		3.3		.7	

Note.—No record Oct. 1 to Mar. 31; ditch probably dry. Ditch dry Apr. 1–21 and Aug. 13 to Sept. 30.

Monthly discharge of Green canal near Monticello, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 26-30	1.9	0	1.16	20.7
May	3.3	0	1.22	75.0
June	2.5	0	.798	47.2
July	2.2	0	.610	37.5
August 1-12	.9	0	.475	11.3
The period				192

NOTE.—See footnote to table of daily discharge.

LITTLE COLORADO RIVER BASIN.

LITTLE COLORADO RIVER NEAR WOODRUFF, ARIZ.

Location.—In T. 16 N., R. 22 E., at highway bridge about 1½ miles below Woodruff, Navajo County, and about 4 miles below Silver Creek.

Drainage area.—Not measured.

Records available.—March 16, 1905, to December 31, 1908; December 5, 1915, to September 30, 1916.

Gage.—Stevens water-stage recorder on right bank just below highway bridge.

Discharge measurements.—From bridge or by wading near bridge.

Channel and control.—Channel consists of bedrock covered with thin deposit of sand and silt. Control not well defined; likely to shift considerably because of the large quantities of silt that are constantly being deposited at low stages and scoured out at each rise. Both banks are clean of vegetation, high, not subject of overflow, and fairly permanent.

Extremes of stage.—Maximum stage during year, from flood marks on gage, 12.7 feet on evening of January 19 (discharge not determined); river dry for about 2 weeks during June and July.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Much of the low-water flow is diverted for irrigation in the vicinity of St. Johns and Snowflake, amount unknown.

Regulation.—There are several small reservoirs in the headwaters of this stream and on Silver Creek that no doubt regulate the flow to some extent.

Accuracy.—Stage-discharge relation not permanent. Rating curve not developed. Mean daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage height. The operation of the recorder was unsatisfactory throughout the year because of unreliable attendant and also because of excessive silt deposits in float well. The gage heights are subject to considerable error and should be used with caution

Discharge measurements of Little Colorado River near Woodruff, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6	M. D. Anderson	1.10	45.9	May 30	D. M. Anderson	1.12	48.7
6	do	1.10	47.1	Aug. 23	Ellsworth and Anderson.	1.18	47
Feb. 10	do	2.15	360	23	do	1.19	49
10	do	2.15	372	Sept. 24	C. E. Ellsworth	1.03	33.2
Apr. 11	do	2.32	290	24	do	1.03	32.1
20	do	2.46	357				
May 30	M. D. Anderson	1.12	48.2				

Daily gage height, in feet, of Little Colorado River near Woodruff, Ariz., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	1.65	....	2.68	2.80	1.90	1.00	0.78	....	....
2	....	1.55	....	2.68	2.90	1.90	.97	.79	....	....
3	....	1.50	....	2.65	2.90	1.88	.93	.90	....	....
4	....	1.50	....	2.58	2.85	1.84	.90	1.15	....	....
5	1.12	1.50	....	2.60	2.90	1.80	.88	1.10	....	....
6	1.10	1.55	....	2.53	2.90	1.75	.88	1.10	....	....
7	....	1.60	....	2.50	2.75	1.70	.80	1.10	1.40	....
8	....	1.55	....	2.52	2.60	1.65	.64	1.10	1.50	....
9	....	1.40	....	2.52	....	1.60	.54	1.10	1.50	....
10	....	1.35	2.20	2.50	....	1.55	.45	1.78	1.50	....
11	.90	2.22	2.35	....	2.30	1.50	.68	1.45	1.50	....
12	.89	2.05	2.44	....	2.27	1.45	.90	....	1.50	....
13	.89	1.65	2.40	3.30	2.28	1.40	.75	....	2.50	....
14	.85	1.42	2.40	3.23	2.28	1.35	.65	....	....	....
15	.91	1.38	2.55	3.16	2.27	1.30	.63	....	....	....
16	.93	1.40	2.58	3.08	2.27	1.30	.98	....	....	....
17	.90	2.83	2.55	3.00	2.30	1.35	.89	....	....	....
18	.90	5.25	2.54	2.93	2.35	1.40	.83	....	....	....
19	.85	8.86	2.53	2.86	2.40	1.46	.81	....	....	....
20	.85	....	2.50	2.79	2.47	1.52	.92	....	....	....
21	.85	....	2.53	2.72	2.40	1.58	.98	....	....	....
22	.93	....	2.52	2.67	2.40	1.64	.90	....	....	....
23	1.05	....	2.50	2.68	2.34	1.70	.85	....	1.19	....
24	1.03	....	2.48	3.25	2.30	1.62	.80	....	1.25	1.03
25	.95	....	....	3.35	2.25	1.54	.80	....	1.46	1.02
26	1.10	....	....	3.35	2.20	1.46	.80	....	....	1.00
27	1.28	....	2.61	3.1	2.15	1.35	.76	....	....	.97
28	1.30	....	2.65	3.05	2.07	1.27	.74	....	....	.94
29	1.32	....	2.65	2.95	2.02	1.20	.73	....	....	.90
30	1.10	....	....	2.85	1.95	1.11	.77	....	....	.88
31	1.30	....	....	2.85	....	1.09	....	....	....	....

NOTE.—See "Accuracy" in station description.

ZUNI RIVER AT BLACK ROCK, N. MEX.

LOCATION.—At the reservoir of the Zuni Indian Reservation at Black Rock, McKinley County. Rio de Los Nutrias, the nearest large tributary, enters from the north, about 4 miles above.

DRAINAGE AREA.—About 660 square miles.

RECORDS AVAILABLE.—Yearly flow July 1, 1903, to June 30, 1905; July 1, 1908, to June 30, 1910. Monthly flow October 1, 1910, to September 30, 1916. Record since July 1, 1908, shows inflow into reservoir.

METHOD OF COLLECTING DATA.—From July 1, 1903, to June 30, 1905, the records were obtained by the ordinary stream-gaging methods. Reservoir completed in 1908. Record beginning July 1, 1908, obtained by means of a gage in the reservoir and a capacity curve for the reservoir, the quantity of water released from the reservoir during the periods of inflow being taken into consideration.

FLOODS.—Channel dry the greater part of the year below the point where it leaves the mountains, but stream is subject to sudden floods of considerable volume and usually of short duration. An account of the flood of September 6, 1909, which damaged the reservoir, is given in Water-Supply Paper 269, pages 206-210.

DIVERSIONS.—A reservoir at Ramah, about 18 miles above the station (the capacity of which is given as 4,240 acre-feet), is used to irrigate about 1,150 acres in T. 11 N., R. 16 W. There are other small ponds or reservoirs in the drainage area.

COOPERATION.—Record furnished by the Office of Indian Affairs, Irrigation Service, through H. F. Robinson, supervising engineer, Alburquerque, N. Mex.

Monthly run-off of Zuni River at Black Rock, N. Mex., for the year ending Spet. 30, 1916.

Month.	Run-off (total in care-feet).	Month.	Run-off (total in acre-feet).
October	0	May	60
November	30	June	0
December	10	July	1,440
January	5,010	August	1,280
February	8,570	September	1,320
March	20,200		
April	4,780	The year	42,700

SILVER CREEK NEAR SNOWFLAKE, ARIZ.[1]

Location.—In T. 13 N., R. 21 E., near mouth of canyon, about 1 mile below Snowflake, Navajo County.

Drainage area.—Not measured.

Records available.—May 4, to December 31, 1906, and December 14, 1915, to December 31, 1916, when station was discontinued.

Gage.—Inclined staff on right bank about 300 feet below mouth of canyon; read by T. W. Tanner. A Richard Fréres water-stage recorder on left bank about 1 mile below the inclined gage was used from December 14, 1915 to January 19, 1916, when it was destroyed by flood.

Discharge measurements.—Made from cable about 100 feet below staff gage, or by wading near staff gage.

Channel and control.—At the staff gage the bed is composed of constantly shifting sand and gravel. At the water-stage recorder a concrete control was constructed which assured a fairly constant stage-discharge relation. It was destroyed at the same time as the gage. The banks at both gages are high, rocky, fairly clean of vegetation, and not subject to overflow.

Extremes of discharge.—Maximum stage from December 14, 1915, to December 31, 1916, 20 feet on January 19, 1916, ascertained from flood marks at location of water-stage recorder (discharge not determined). It is reported that the stream is practically dry for various periods during the irrigation season nearly every year, the only flow being return water from the irrigated areas near Snowflake.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Much of the low-water flow is diverted for irrigation above the station.

Storage.—Some storage is developed above the station for irrigation. Amount unknown.

Accuracy.—Stage-discharge relation not permanent because of shifting control (see "Channel and control"). Rating curve not developed. Gage read to tenths twice a week. Data inadequate for determination of discharge.

Discharge measurements of Silver Creek near Snowflake, Ariz., for period December 14, 1915, to December 31, 1916.

Date.	Made by—	Gage height[b]	Discharge.	Date.	Made by—	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 14	Anderson and Guthrie	1.65	8.3	Aug .24	Ellsworth and Anderson	0.95	3.8
Feb. 12	M. D. Anderson	2.00	510	24	.....do	.95	3.2
Apr. 20	.....do	.85	25.6	Sept. 23	C. E. Ellsworth	1.20	10.6
20	.....do	.85	25.2	23	.....do	1.20	11.2

[a] Measurement on Dec. 14 referred to water-stage recorder; all other measurements referred to inclined staff gage 1 mile upstream. No determined relation between the two gages.

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[1] In report for 1906 called "Silver Creek at Canyon Station" near Snowflake, Ariz.

Daily gage height, in feet, of Silver Creek near Snowflake, Ariz., for the period Dec. 14, 1915, to Dec. 31, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.95						0.8	1.5				
2		1.95				0.3				0.9			1.4
3		1.8					0.5				1.4		
4		1.95		1.1	1.5			.7				1.4	
5		1.9							1.4	1.0			1.0
6		1.85				.3	.8						
7		1.8		1.6							1.4	1.1	
8		1.85			1.3			1.0	1.0				
9		1.85				.5				1.5			1.0
10		2.90					.8				3.1		
11		2.5		1.3	1.5			1.2				1.1	
12		2.0	2.0						.9	1.7			1.15
13		1.7				.5	.8						
14	1.55	1.8	1.9	1.1							2.2	1.4	
15	1.65	1.7			1.4			1.4	3.0				
16	1.65	1.8				.6				2.5			1.2
17	1.7						.8				2.1		
18	1.65		1.5	1.0	1.0			1.0				1.2	
19	1.6								1.3	1.7			1.1
20	1.65					.7	.8						
21	1.65			1.1							1.5	1.4	
22	1.8		1.9		.8			.9	1.2				
23	1.75					.7				1.1			1.15
24	1.75						.8				1.1	1.3	
25	1.75			3.9	.8			2.4					
26	1.7		1.5						1.4	1.4			1.2
27	1.7					.7	.8						
28	1.75			2.5							1.2	1.5	
29	1.75		2.1		.3			2.0	1.3				
30	1.9					.5				1.5			1.35
31	1.75			1.4							1.4		

NOTE.—See "Gage" and "Accuracy" in station description.

CHEVELON FORK NEAR WINSLOW, ARIZ.

LOCATION.—In T. 18 N., R. 17 E., 300 yards below highway bridge, 1 mile above concrete division dam, about 1½ miles above junction with Little Colorado River, and about 14 miles southeast of Winslow, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 18, 1905, to December 12, 1908; December 18, 1915, to September 30, 1916.

GAGE.—Stevens water-stage recorder attached to rock ledge on right bank 300 yards below highway bridge.

DISCHARGE MEASUREMENTS.—Made from cable, or by wading.

CHANNEL AND CONTROL.—Channel bed consists of fairly permanent sand and gravel. Both banks clean, gradually rising to well above high water. Control is at diversion dam about 1 mile below gage; practically permanent for high and medium stages; at low stages it shifts considerably owing to unstable conditions at canal heading.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 13.2 feet at 9 a. m., January 19 (discharge not determined); minimum discharge about 2 second-feet for several days during June, July, and August.

ACCURACY.—Stage-discharge relation practically permanent, except at low stages, when it is affected by the operation of a loosely constructed canal heading below the gage. Three poorly defined rating curves used as follows: December 18 to January 17, February 8 to May 29, and August 23 to September 30. Operation of recorder satisfactory except as indicated in footnote to monthly-discharge table. Daily discharge ascertained by shifting-control method or by applying to rating table daily gage height determined by inspecting gage-height graph, or by averaging hourly gage heights during rapidly fluctuating stages. Daily discharge not published because of insufficient discharge measurements and shifting control at low stages. Records roughly approximate.

Discharge measurements of Chevelon Fork near Winslow, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 18	M. D. Anderson	0.65	4.6	Aug. 22	Ellsworth and Anderson	0.92	3.9
May 29	.....do	.90	6.7	Sept. 25	C. E. Ellsworth	.94	4.0
29	.....do	.90	6.7	25	.....do	.94	5.4
Aug. 22	Ellsworth and Anderson	.92	4.0				

NOTE.—High-water portion of rating curve based on measurement made Apr. 5, 1917: Gage height, 2.52 feet; discharge, 283 second-feet.

Monthly discharge of Chevelon Fork near Winslow, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 18–31	6	4	5.1	142
January 1–18	944	3	58.9	2,100
February 8–29	924	250	439	19,200
March	1,350	196	629	38,700
April	417	19	124	7,380
May	18	2	7.2	443
June	6	2	3.6	214
July	10	2	3.8	234
August	70	2	6.2	381
September	366	3	32.0	1,900

NOTE.—Gage heights Jan. 10–14 have no significance on account of operation of canal head gate; discharge interpolated. Mean daily gage height Jan. 20, 10.6 feet; discharge not determined. Recorder not working properly Apr. 8–11; May 5–13 and 24–28; June 12–24; discharge interpolated. See "Accuracy" in station description.

VIRGIN RIVER BASIN.

VIRGIN RIVER AT VIRGIN, UTAH.

LOCATION.—In the NW. ¼ sec. 27 or the NE. ¼ sec. 28, T. 41 S., R. 12 W., a few hundred feet above point where river enters a steep, narrow gorge and three-quarters of a mile west of Virgin, Washington County. Station replaces the one maintained prior to February, 1915, at a site half a mile above Virgin and gives practically the same record of flow.

DRAINAGE AREA.—1,010 square miles.

RECORDS AVAILABLE.—April 18, 1909, to September 30, 1916.

GAGE.—Chain gage on the right bank near the lower end of sandstone bluff. Installed February 1, 1915; read by Niles Earl. Gage used April 18 to August 31, 1909, was an inclined staff on right bank half a mile above Virgin and a few hundred feet below North Creek; washed out August 31, 1909, and replaced October 14 by an inclined staff on left bank at a new datum. This gage was damaged by flood January 1, 1910, and on January 25 a new inclined staff was installed also on left bank about 65 feet upstream and at datum 0.8 foot higher than the gage installed October 14, 1909. This gage was used until chain gage was installed below Virgin February 1, 1915.

DISCHARGE MEASUREMENTS.—Made by wading below the gage except during high water, when the old cable above Virgin must be used.

CHANNEL AND CONTROL.—Bed consists of sand and gravel. Right bank high; left bank low and is overflowed. One channel at all stages. Control is a gravel bar a short distance below the gage; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.6 feet at 7.35 p. m. July 26 (discharge, 4,350 second-feet); discharge at 7 p. m. August 3, estimated at 6,000 second-feet by C. S. Jarvis, civil engineer; minimum stage recorded, 2.38 feet February 1 (discharge, 117 second-feet).

1909–1916: Maximum stage recorded, 11.6 feet at upper station October 27, 1912 (discharge estimated 12,000 second-feet). The flood of August 31, 1909, probably equaled or exceeded this flow. Minimum discharge, 24 second-feet July 1, 2, 4, and 5, 1909.

ICE.—Stage-discharge relation not affected by ice to any extent.

DIVERSIONS.—Above all important diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation usually changed by floods, which occurred frequently during year but was fairly constant for periods of ordinary flow. Rating curves used as standard, fairly well defined for range in stage except for peaks of floods of short duration; other curves drawn parallel to these through single discharge measurement used November 8 to March 20 and March 25–31. Gage read to hundredths once a day about five or six times a week. Daily discharge determined by applying daily gage height to rating table, except for periods when stage-discharge relation was affected by shifting control and during floods. Discharge interpolated for days when gage was not read. Records fair.

Discharge measurements of Virgin River at Virgin, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 11	L. A. Snow	2.50	164	May 25	A. B. Purton	2.69	456
Mar. 31	C. C. Jacob	2.90	535	July 27	L. A. Snow	3.02	692

Daily discharge, in second-feet, of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	131	189	236	209	117	224	586	801	357	209	375	176
2	131	200	248	206	156	212	657	801	357	200	575	166
3	131	212	248	203	156	200	728	844	357	200	2,000	156
4	145	224	284	200	156	200	1,030	906	334	192	500	146
5	145	236	278	224	162	652	879	968	357	176	3,000	150
6	156	248	272	248	167	444	728	1,030	346	168	350	153
7	156	1,050	236	189	236	236	675	810	335	168	263	150
8	156	178	224	212	254	272	622	788	324	184	2,000	146
9	156	320	236	200	272	424	622	767	313	200	250	292
10	156	232	212	189	272	424	860	728	308	184	200	242
11	145	145	206	162	266	424	793	767	308	160	200	192
12	145	138	200	131	260	615	746	731	282	153	200	168
13	150	152	236	144	212	690	660	696	282	153	200	530
14	156	167	248	156	200	766	698	660	268	233	408	400
15	167	167	260	224	189	690	784	645	254	313	209	269
16	178	167	254	192	260	615	869	813	249	235	196	138
17	178	156	248	359	200	615	1,230	484	244	209	184	153
18	178	156	260	1,080	167	578	1,140	655	235	168	188	168
19	178	172	200	578	236	690	1,050	826	226	176	192	160
20	178	189	200	236	248	842	784	318	222	176	168	153
21	167	189	200	145	290	3,300	831	535	218	172	184	164
22	167	178	194	131	333	2,600	878	752	214	168	172	174
23	178	178	189	145	272	1,900	965	612	209	168	160	184
24	178	189	178	131	212	1,200	965	472	209	184	173	153
25	189	200	178	189	167	720	1,330	446	200	1,480	186	146
26	212	200	178	254	212	844	1,100	424	209	2,180	200	168
27	212	224	178	320	236	844	1,240	403	209	1,190	192	153
28	248	224	224	652	424	886	1,090	392	200	790	168	164
29	248	224	224	395	272	929	947	380	192	391	200	176
30	189	230	224	138	......	645	801	403	196	357	196	188
31	200	......	212	128	......	530	......	334	......	313	192	......

NOTE.—Daily discharge Aug. 1–9 determined from a rough hourly, discharge hydrograph plotted from observer's gage-height record and estimates of floods on Aug. 3, 5, and 8 furnished by C. S. Jarvis, civil engineer, Salt Lake City, Utah; results only roughly approximate.

Monthly discharge of Virgin River at Virgin, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	248	131	171	10,500
November	1,050	138	224	13,300
December	284	178	225	13,800
January	1,080	128	257	15,800
February	424	117	228	13,100
March	3,300	200	781	48,000
April	1,330	586	876	52,100
May	1,030	313	635	39,000
June	357	192	267	15,900
July	2,180	153	363	22,300
August	3,000	160	441	27,100
September	530	138	193	11,500
The year	3,300	117	389	282,000

LEEDS (QUAIL) CREEK NEAR LEEDS, UTAH.

Location.—In the N. ½ sec. 36, T. 40 S., R. 14 W., just above heading of R. C. Savage's canal and about a quarter of a mile above head of Leeds canal, three-quarters of a mile north of the abandoned mining camp of Silver Reef, and 2½ miles north of Leeds, Washington, County.

Drainage area.—Not measured.

Records available.—January 31, 1915, to September 30, 1916.

Gage.—Vertical staff on left bank 60 feet above the head of the Savage ditch. Read by R. C. Savage.

Discharge measurements.—Made by wading.

Channel and control.—Stream bed consists of gravel and boulders; shifts occasionally.

Extremes of discharge.—Maximum stage recorded during year, 5.0 feet, August 3 (discharge not determined); minimum stage recorded, 2.00 feet in November and December (discharge 4.2 second-feet).

1915–1916: Maximum stage recorded, that of this year; minimum stage, 1.98 feet, January 31, 1915 (discharge 3.9 second-feet).

Ice.—Stage-discharge relation probably not seriously affected by ice for any length of time.

Diversions.—Above all diversions. R. C. Savage diverts water about 60 feet below the station for irrigation and domestic uses. Measurements of this ditch have shown from 1 to 3 second-feet. Measurements of Leeds canal which diverts about a quarter of a mile below have shown discharges up to 18.5 second-feet.

Regulation.—None.

Accuracy.—Stage-discharge relation changed by high water January 18 and again August 3. Rating curves fairly well defined between 3 and 30 second-feet. Gage read to hundredths two or three times a week. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Leeds (Quail) Creek during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. [a]13	L. A. Snow	2.20	6.74	May 26	A. B. Purton	2.48	21.5
Mar. 31	C. C. Jacob	2.55	28.0	July 27	L. A. Snow	3.20	14.8

[a] Stage-discharge relation probably affected by ice gorges.

Daily discharge, in second-feet, of Leeds (Quail) Creek near Leeds, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.2			4.2		10	17				10	
2	5.2		4.2			10			23			
3						10			23	31		
4			5.5			12		24			8.9	
5							24	23	24			
6	4.8						24	23		31		
7			4.2				24				8.6	
8				4.2		18	24	23				
9	4.8					24			23			
10						24			23	31		
11		5.0	4.2			38		23				7.2
12		5.0					22	23	24		8.6	
13				6.7			20	23		28		7.2
14				5.0			20		24			
15						18	22	23		27	8.3	
16	4.8				10	18		24				7.0
17			4.2		10	18			27			
18			4.2		10	17			28	17		
19					10		23			12	8.3	7.0
20				5.2						10		
21						24	23		28	10		
22				5.2		25	23			10		
23	4.8					30						7.0
24					10	20			28	10	8.3	
25			4.2		10	25						5.5
26					10		22	22				5.5
27		4.2			10		23	23		15		
28					10		23		31			
29					10		23	23	31	10		
30						17			31			
31						22						

NOTE.—Daily discharge is given for days on which gage was read.

SANTA CLARA CREEK NEAR CENTRAL, UTAH.

LOCATION.—In sec. 11, T. 39 S., R. 16 W., just above ford at R. H. Hunt's ranch, about a mile southeast of Central, Washington County, on road to Pine Valley. Hunt's spring, which has fairly constant discharge of about 3 second-feet, enters 10 feet below the gage.

DRAINAGE AREA.—84 square miles.

RECORDS AVAILABLE.—April 21, 1909, to September 30, 1916.

GAGE.—Vertical staff nailed to cottonwood tree on left bank about 20 feet above the ford; read by R. H. Hunt. Datum of gage was raised 0.45 foot on January 20, 1910, and 2 feet on February 22, 1916.

DISCHARGE MEASUREMENTS.—Made by wading, or from footbridge.

CHANNEL AND CONTROL.—Stream bed consists of gravel and boulders. Both banks fairly high but may be overflowed at extreme stages; one channel at all stages. Control is at a riffle formed by small boulders just below ford; shifts at times. Stage of zero flow about 0.2 foot, February 22, 1916 datum.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.90 feet (5.35 original 1909 datum) at 7.30 a. m. March 29 (discharge 407 second-feet); minimum stage 0.95 foot (3.40 original datum), December 14–29 (discharge 12 second-feet).

1909–1916: Maximum stage recorded 7.5 feet (5.05 feet present datum) January 1, 1910 (discharge estimated by extending later rating curves and assuming no backwater effect from drift, etc., to be probably 1,200 or 1,300 second-feet. This result is only roughly approximate as no discharge measurements have been made above about 400 second-feet). Minimum discharge, 5 second-feet, February 6–8 and September 10–17, 1914.

Ice.—Stage-discharge relation not usually affected by ice.

Diversions.—The New Castle Reclamation Co. has constructed a reservoir on Grass Valley Creek with a capacity of 23,000 acre-feet. Water is taken from Santa Clara Creek above the town of Pine Valley, stored in the reservoir, and diverted by means of a tunnel through the rim of the Great Basin to irrigate lands outside the Colorado River basin. The Central canal diverts water about 2 miles above station for irrigation of lands near Central. This canal has been measured when it was carrying 16 second-feet.

Regulation.—Flow affected by the diversions and storage noted above.

Accuracy.—Control fairly permanent. Rating curve is well defined from 0 to 100 second-feet and fairly well defined up to 400 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Santa Clara Creek near Central, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 22	L. A. Snow	1.05	17.0
May 28[a]	A. B. Purton	1.27	34.8
June 19	L. A. Snow	1.38	47.9

[a] Stage of zero flow. 0.2 ±0.1 foot.

Daily discharge, in second-feet, of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20	22	17	14	20	22	66	42	32	30	68	19
2	20	22	17	16	20	23	61	39	30	30	50	18
3	20	22	17	19	24	22	56	42	30	30	46	18
4	20	22	17	18	24	74	50	42	30	30	93	16
5	20	22	17	16	24	106	46	58	30	28	104	19
6	20	32	17	14	20	32	37	66	34	28	52	20
7	20	28	17	15	20	28	33	83	37	28	37	20
8	20	24	17	15	20	32	33	72	46	28	30	20
9	20	20	17	20	20	35	33	66	54	28	30	20
10	20	20	17	17	20	149	33	61	56	26	30	20
11	20	20	17	14	28	93	33	56	56	26	26	20
12	20	20	17	14	28	74	41	50	54	25	26	20
13	20	19	14	14	26	54	37	44	50	25	26	20
14	20	18	12	14	26	46	37	41	50	28	25	19
15	20	17	12	14	26	42	39	37	48	33	25	19
16	20	18	12	14	26	39	41	37	44	28	22	19
17	20	19	12	15	26	35	41	37	42	30	19	19
18	20	19	12	116	26	37	42	39	42	32	18	19
19	20	18	12	37	26	57	42	50	41	33	18	19
20	20	17	12	32	24	63	44	48	42	33	18	19
21	20	17	12	28	20	407	46	37	39	33	15	19
22	20	17	12	24	17	142	54	37	39	33	15	19
23	20	17	12	20	20	154	58	35	37	33	14	19
24	20	17	12	18	22	166	61	35	37	34	13	19
25	20	16	12	17	22	112	66	35	38	35	13	19
26	22	15	12	17	23	329	71	35	39	35	13	19
27	22	15	12	56	23	133	61	33	39	33	14	19
28	22	16	12	37	23	112	104	33	35	44	15	19
29	22	17	12	30	22	92	83	33	32	37	23	19
30	22	17	14	24	......	71	62	32	32	36	23	19
31	22	......	14	19	......	71	......	32	......	35	19	......

Note.—Gage not read, discharge interpolated, for following days: Oct. 4, 11, 14, 18, 21, 24, 28, 30, Nov. 1, 4; about every other day Nov. 10 to Dec. 28; Jan. 2, 4, 10, 14, 16, 22, 24, 29, Feb. 1, 4, 7, 9, 14, 17, 21, 23, 25, 27, 29, Mar. 8, 12, 15, 23, 29, Apr. 1, 3, 9, 18, 23, 30, May 16, June 6, 18, 25, July 2, 7, 24, 30, Aug. 9, Sept. 6, 8, 9, 12, 20, and 27.

Monthly discharge of Santa Clara Creek near Central, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	22	20	20.4	1,250
November	32	15	19.4	1,150
December	17	12	14.1	867
January	116	14	23.8	1,460
February	28	17	23.0	1,320
March	407	22	92.0	5,660
April	104	33	50.4	3,000
May	83	32	44.7	2,750
June	56	30	40.5	2,410
July	44	25	31.2	1,920
August	104	13	30.3	1,860
September	20	16	19.1	1,140
The year	407	12	34.2	24,800

MUDDY RIVER NEAR MOAPA, NEV.

Location.—In the SE. ¼ sec. 15, T. 14 S., R. 65 E., at the concrete weir about three-quarters of a mile below Home ranch, 6 miles northwest of Moapa, Clark County, a short distance below the springs that form the source of the stream.

Drainage area.—1,080 square miles. A large drainage area above Arrow Canyon is tributary to Muddy River but produces no surface run-off except during cloud-bursts or periods of heavy rainfall.

Records available.—July 1, 1913, to September 30, 1915, and April 20 to September 30, 1916.

Gage.—Stevens water-stage recorder in pool above weir.

Discharge measurements.—Made from a footplank below weir.

Control.—A 10-foot Cippoletti weir. Stage of zero flow, zero on gage.

Extremes of discharge.—The actual maximum stage was not recorded as the pencil carriage stuck, but from comparison with the record at the Indian reservation it occurred about midnight July 24. Discharge estimated from record below at 68 second-feet, corresponding to a stage of about 2.3 feet. Minimum stage determined by inspection of trace when clock was stopped to be 1.05 feet between July 2 and 14 (discharge, 36 second-feet).

1913–1916: Maximum stage recorded, 9.9 feet at 11 p. m. February 21, 1914 (discharge estimated 765 second-feet); minimum discharge 36 second-feet between July 2 and 14, 1916.

Ice.—Stage-discharge relation not affected by ice but stream is subject to sudden freshets in winter.

Diversions.—Several ranch ditches divert water for irrigation above station.

Regulation.—Flow affected somewhat by diversions above.

Accuracy.—Deposition of sand above weir increases velocity of approach and changes stage-discharge relation. Range of stage small except for short peak floods; curves reasonably well defined between 40 and 50 second-feet. Operation of water-stage recorder satisfactory except during a few short periods. Daily discharge ascertained by applying to rating table gage height obtained from recorder graph or, for days of considerable fluctuation, by averaging hourly discharge. Records good.

Discharge measurements of Muddy River near Moapa, Nev., during the year ending Sept. 30, 1916.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
May 1	1.14	39.2	Sept. 6	1.20	44.7
July 16	1.22	45.6	17	1.24	45.6
19	1.26	47.0			

Daily discharge, in second-feet, of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		40	43	44	49	46	16		47	43	47	42	46
2		40	43	45	50	46	17		46	44	47	42	46
3		42	43		54	46	18		46	46	46	42	46
4		44	43		55	46	19		46	46	46	42	46
5		43	43		49	45	20	46	45	45	46	42	46
6		43	43		48	44	21	44	45	42	46	42	47
7		45	44		48	43	22	45	44	46	47	42	47
8		45	43	38	48	42	23	45	45	46	46	42	47
9		44	40	43	47	42	24	46	46	47	51	44	45
10		43	40	42	47	42	25		46	46	57	46	43
11		44	39	40	47	43	26		46	46	45	46	44
12		46	41	38	46	43	27		47	46	52	46	43
13		45	42	40	45	45	28		46	46	54	46	43
14		46	42	43	44	46	29		46	43	52	46	43
15		47	42	45	44	46	30		46	43	49	46	43
							31		46		49	46	

NOTE.—Discharge estimated, because of breaks in gage-height record, by comparison with records of flow for station at the Indian reservation, as follows: Apr. 25–30, 43 second-feet; July 3–7, 42 second-feet.

Monthly discharge of Muddy River near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 20–30	46		44.0	960
May	47	40	44.8	2,750
June	47	39	43.5	2,590
July	57	38	45.5	2,800
August	55	42	45.9	2,820
September	47	42	44.7	2,660
The period				14,600

MUDDY RIVER ABOVE MOAPA RIVER INDIAN RESERVATION, NEAR MOAPA, NEV.

Location.—In the SW. ¼ sec. 26, T. 14 S., R. 65 E., about a quarter of a mile above upper end of the Moapa River Indian Reservation, and 5 miles west of Moapa, Clark County.

Drainage area.—1,100 square miles.

Records available.—August 24, 1914, to September 30, 1916. Several current-meter measurements were made in 1914 before the gage-height record was started.

Gage.—Stevens water-stage recorder installed August 24, 1914; moved 90 feet downstream December 14, 1915, and datum lowered 0.06 foot. Current meter measurements prior to August 24, 1914, referred to a vertical staff at the upper site.

Discharge measurements.—Made from a footbridge about 85 feet above gage.

Channel and control.—Bed consists of clay and limestone deposit, with some sand and vegetal growth. One channel at all stages but banks are overflowed during excessive floods. Control is a limestone reef about 20 feet below the present gage. Stage of zero flow approximately −2.0 feet.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 3.02 feet at 1.30 a. m. July 25 (discharge 69 second-feet); maximum discharge, 70 second-feet from 2 to 7 p. m. November 6, stage 2.97 feet (2.82 feet, referred to datum used after December 14). Stage-discharge relation affected by moss. Minimum stage recorded, 1.74 feet from 3 to 10 p. m. July 12 (discharge 36 second-feet).

1914–1916: Maximum stage, 3.21 feet at 4 a. m. February 11, 1915 (discharge 86 second-feet); minimum stage, 1.74 feet from 3 to 10 p. m. July 12, 1916 (discharge 36 second-feet).

Ice.—Stage-discharge relation not affected by ice. Except for sudden freshets flow is very uniform as stream is fed by springs.

Diversions.—One small diversion and some seepage and return flow between this station and the one 2 miles above at the Home ranch.

Regulation.—Flow affected somewhat by the diversions at the Home ranch.

Accuracy.—Stage-discharge relation affected by moss. Rating curves fairly well defined from 40 to 50 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table gage height obtained by inspecting gage-height graph; discharge November 6, January 27, 28, July 24, 25, 27, 28, and August 3, and 4 determined by averaging hourly discharge. Records good.

Discharge measurements of Muddy River above Moapa River Indian reservation near Moapa, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 18	Leonard Tanner	2.16	49.4	June 29	Leonard Tanner	1.88	40.1
Jan. 6	do	[a] 1.99	51.4	July 26	do	2.05	43.7
Apr. 6 [b]	L. W. Jordan	1.87	44.8	28	do	2.28	49.7
May 4	Leonard Tanner	1.92	45.7	Sept. 18	do	2.16	45.7
27	do	2.16	47.9				

[a] Gage at old site read 2.14 feet.

[b] Stage of zero flow determined to be approximately −2.0 feet.

Daily discharge, in second-feet, of Muddy River above Moapa River Indian reservation near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	47	49	51	52	48	46	45	46	44	48	45
2	44	48	49	51	52	48	46	44	44	45	48	44
3	44	48	50	51	52	48	46	46	45	43	52	44
4	44	48	50	51	52	49	46	48	44	42	52	44
5	47	48	50	51	51	49	47	47	44	42	48	43
6	47	58	50	51	51	50	46	46	44	40	48	44
7	46	52	50	51	51	49	46	48	44	38	48	43
8	47	50	50	51	51	49	46	47	43	38	48	42
9	44	49	50	51	51	49	48	47	41	44	48	43
10	44	49	50	51	51	49	46	46	41	40	48	43
11	44	49	49	51	51	48	46	46	40	38	48	44
12	45	49	50	51	51	48	47	48	41	38	46	44
13	46	49	50	51	51	49	47	47	42	39	44	45
14	47	50	50	51	51	49	48	47	42	42	43	46
15	47	50	50	51	51	48	48	48	42	44	43	46
16	47	50	50	51	50	48	49	47	43	46	42	46
17	47	49	50	53	50	48	48	46	43	43	42	46
18	47	49	50	54	50	49	48	46	46	44	42	46
19	47	49	50	52	50	50	48	46	46	46	41	46
20	47	49	50	52	50	50	48	45	44	46	42	46
21	47	49	50	51	55	50	49	45	42	46	42	45
22	47	49	50	51	55	50	49	44	46	46	42	45
23	47	49	50	51	51	49	48	45	46	46	42	46
24	47	49	50	51	51	48	48	46	46	48	42	43
25	47	49	50	51	50	47	47	47	46	54	46	42
26	47	49	50	51	49	46	46	47	46	46	45	42
27	47	49	50	54	49	46	45	47	46	50	46	42
28	47	49	50	59	49	46	44	47	45	52	46	41
29	47	49	50	52	49	46	44	47	42	53	46	41
30	47	49	50	52	......	47	46	47	43	48	45	42
31	47	......	50	52	......	46	......	47	......	48	45	......

Monthly discharge of Muddy River above Moapa River Indian reservation near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	47	42	46.1	2,830
November	58	47	49.3	2,930
December	50	49	49.9	3,070
January	59	51	51.7	3,180
February	55	49	50.9	2,930
March	50	46	48.3	2,970
April	49	44	46.9	2,790
May	48	44	46.4	2,850
June	46	40	43.8	2,610
July	54	38	44.5	2,740
August	52	41	45.4	2,790
September	46	41	44.0	2,620
The year	59	38	47.3	34,300

MUDDY RIVER AT RAILROAD PUMPING PLANT NEAR MOAPA, NEV.

Location.—In sec. 5, T. 15 S., R. 66 E., at railroad bridge on main-line track of Salt Lake Route, about a mile below the Indian Reservation and 1¼ miles south of Moapa, Clark County. Above confluence of Meadow Valley Wash.

Drainage area.—Not measured.

Records available.—November 8, 1914, to September 30, 1916.

Gage.—Vertical staff on right bank attached to pile of railroad bridge; read by James Borbridge.

Discharge measurements.—Made from footplank about 150 feet below gage.

Channel and control.—Bed composed of clay. Banks comparatively low; overflowed during freshets; one channel at all stages. There is a well defined riffle 200 feet below gage, but stage-discharge relation is evidently affected by changes in channel between gage and riffle.

Extremes of discharge.—Maximum stage recorded during year, 1.3 feet at 5 p. m. January 18 (discharge estimated by prolonging rating curve, 63 second-feet); minimum stage recorded, 0.28 foot at 6 p. m. July 12 (discharge, 33 second-feet).

1914–1916: Maximum stage recorded, 2.4 feet at 3 p. m. February 11, 1915 (discharge about 145 second-feet); minimum discharge, 29 second-feet at 6.30 p. m. June 20, 1915.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Water to irrigate about 200 acres is diverted at the Indian Reservation and also for a ranch between the reservation and the station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Range of stage small; direction of rating curves not accurately determined. Gage read to hundredths twice daily. Daily discharge ascertained by applying gage height to rating table; shifting-control method used October 1–4 and April 1–30. Records fair.

Discharge measurements of Muddy River at railroad pumping plant near Moapa, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 23	Leonard Tanner........	0.78	49.3	May 27	Leonard Tanner........	0.78	45.8
Apr. 6	L. W. Jordan..........	.54	42.1	Sept. 18	.....do..................	0.72	42.6
May 4	Leonard Tanner........	.56	39.9				

Daily discharge, in second-feet, of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	48	49	49	49	46	46	41	43	44	43	43
2	42	48	49	50	49	46	43	38	39	44	43	43
3	44	47	49	50	49	46	42	38	40	38	44	41
4	43	47	50	50	49	46	42	40	40	38	44	41
5	48	47	50	49	49	48	44	38	39	36	43	41
6	48	54	50	48	50	47	41	38	38	37	43	43
7	48	54	49	48	49	45	40	41	38	35	42	43
8	48	50	49	48	49	46	43	41	38	38	42	42
9	48	49	49	48	48	47	41	40	36	40	42	42
10	46	49	49	48	48	47	43	39	36	42	42	41
11	46	49	49	48	48	46	40	39	36	36	44	42
12	45	49	50	48	48	46	44	39	36	34	44	42
13	45	49	50	48	48	47	40	40	36	35	42	41
14	48	49	50	48	48	48	42	41	38	41	42	43
15	48	50	50	48	48	45	40	42	37	40	42	44
16	48	50	50	49	48	46	42	41	38	41	41	44
17	48	50	50	51	48	44	42	40	38	41	39	44
18	48	50	50	57	48	45	42	39	42	42	39	44
19	48	48	50	52	48	46	43	39	42	42	38	44
20	48	49	49	50	48	46	42	40	41	41	37	45
21	46	49	49	49	50	46	43	41	39	42	37	44
22	46	49	49	49	53	46	44	40	41	42	38	42
23	46	49	50	49	49	45	42	40	43	42	37	43
24	46	49	50	49	48	45	42	42	42	42	38	42
25	47	49	49	49	48	44	42	43	40	44	42	40
26	46	49	49	48	47	46	40	44	40	44	39	41
27	47	49	48	51	47	44	41	46	39	43	40	40
28	47	49	49	54	46	44	38	46	39	46	43	40
29	48	49	48	51	46	42	38	44	39	45	42	39
30	47	49	48	51	....	42	38	42	42	44	43	39
31	48	....	50	50	....	44	....	42	....	43	43	....

Monthly discharge of Muddy River at railroad pumping plant near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	48	40	46.5	2.860
November	54	47	49.2	2,930
December	50	48	49.4	3,040
January	57	48	49.6	3,050
February	53	46	48.4	2,780
March	48	42	45.5	2,800
April	46	38	41.7	2.480
May	46	38	40.8	2,510
June	43	36	39.2	2,330
July	46	34	40.7	2,500
August	44	37	41.2	2.530
September	45	39	42.1	2,510
The year	57	34	44.4	32,300

MUDDY RIVER AT WEISER RANCH, NEAR MOAPA, NEV.

Location.—In the NE. ¼ sec. 2, T. 15 S., R. 66 E., 250 feet below intake of Weiser canal, a quarter of a mile above mouth of Meadow Valley Wash, 1 mile above Weiser ranch house, and 3 miles southeast of Moapa, Clark County.

Drainage area.—Not measured.

Records available.—November 17, 1915, to September 30, 1916.

Gage.—Stevens water-stage recorder on left bank. Datum lowered 1 foot February 17; published gage heights refer to present datum.

Discharge measurements.—Made by wading about 150 feet above gage.

Channel and control.—Bed composed of clay; clean but subject to scouring and filling; one channel at all stages. Control at remains of an old dam; loose rock and firm clay but shifting.

Extremes of discharge.—Maximum stage recorded during year from water-stage recorder, 3.12 feet at 7 a. m. August 4 (discharge 69 second-feet); minimum discharge 21 second-feet at 1 p. m. July 13.

Ice.—Stage-discharge relation not affected by ice; flow very uniform except for sudden freshets, usually of short duration, due to storms.

Diversions.—The Weiser canal diverts about 250 feet above gage and there are numerous diversions farther upstream.

Accuracy.—Stage-discharge relation not permanent; channel much cut at times. Rating curve fairly well defined between 25 and 50 second-feet. Water-stage recorder out of commission January 12 to February 16. Daily discharge ascertained by applying gage height to rating table; shifting-control method used December 4 to January 11 and August 4 to September 30.

Discharge measurements of Muddy River at Weiser ranch, near Moapa, Nev., during the year ending Sept. 30, 1916.

[Made by Leonard Tanner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 3	1.72	50.0	Mar. 16	1.62	46.3	June 27	1.20	29.0
Jan. 3	1.48	49.7	Apr. 6	1.50	41.4	July 13	1.11	25.0

Daily discharge, in second-feet, of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	51	50	......	47	41	36	39	33	36	36
2	......	51	51	......	46	39	35	35	35	36	37
3	......	50	50	......	47	41	35	35	34	36	35
4	......	51	49	......	47	41	34	35	32	49	36
5	......	51	49	......	48	42	34	36	31	53	36
6	......	51	47	......	48	41	34	35	31	44	36
7	......	52	48	......	46	40	35	35	31	41	35
8	......	52	48	......	46	41	37	35	31	41	38
9	......	52	46	......	46	40	37	33	31	37	36
10	......	51	48	......	47	40	37	32	33	37	36
11	......	51	47	......	46	38	35	30	31	42	34
12	......	51	......	......	46	40	35	29	31	40	35
13	......	50	......	......	48	39	36	31	28	42	36
14	......	50	......	......	48	40	36	31	28	38	36
15	......	49	......	......	46	39	38	31	30	38	36
16	......	48	......	......	46	38	38	31	30	38	34
17	51	50	......	50	45	38	38	30	31	38	35
18	51	50	......	50	44	38	35	30	31	38	36
19	50	49	......	50	45	41	35	36	31	34	38
20	50	49	......	49	45	39	37	37	31	31	37
21	50	49	......	50	43	39	38	36	31	32	36
22	50	50	......	52	44	39	37	34	33	36	37
23	50	50	......	53	42	42	37	35	34	37	38
24	51	49	......	52	42	39	39	34	33	37	38
25	51	50	......	50	42	38	41	34	35	38	41
26	50	50	......	49	44	37	41	33	35	38	39
27	50	49	......	49	43	37	43	31	36	38	35
28	50	47	......	49	42	36	42	29	44	39	34
29	50	47	......	47	41	36	40	30	47	39	34
30	51	47	......	......	41	34	39	32	42	38	33
31	......	48	50	......	40	......	40	......	37	37	......

Note.—Discharge estimated by comparison with records of flow for station at the pumping plant as follows: Jan. 12–30 and Feb. 1–16, 49 second-feet.

Monthly discharge of Muddy River at Weiser ranch, near Moapa, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 17–30	51	50	50.4	1,400
December	52	47	49.8	3,060
January	....	....	48.8	3,000
February	....	....	49.6	2,850
March	48	40	44.9	2,760
April	42	34	39.1	2,330
May	43	34	37.2	2,290
June	39	29	33.1	1,970
July	47	28	33.3	2,050
August	53	31	38.6	2,370
September	41	33	36.1	2,150
The period	....	....	....	26,200

MUDDY RIVER NEAR ST. THOMAS, NEV.

Location.—In sec. 13, T. 17 S., R. 68 E., about a quarter of a mile above the confluence of Muddy River with the Virgin, and 1½ miles below St. Thomas, Clark County.

Drainage area.—3,980 square miles.

Records available.—May 23, 1913, to September 30, 1916.

Gage.—Vertical staff on right bank about a quarter of a mile above the mouth of the stream; read by J. H. Foxley. Installed March 15, 1914, to replace the gage washed out on February 22, 1914. The gage used May 23, 1913, to February 22, 1914, was a vertical staff half a mile upstream from the present site.

Discharge measurements.—Made by wading.

Channel and control.—Stream bed of clay and mud; shifting; channel materially changed by floods.

Extremes of discharge.—Maximum stage recorded during year, 8.7 feet at 5 p. m. January 20 (discharge estimated very roughly at 1,700 second-feet); minimum discharge practically zero in September.

1913–1916: Maximum discharge occurred about 6 a. m. February 22, 1914, estimated later by Leonard Tanner, Water Commissioner, using Kutter's formula, to have been about 6,500 second-feet; water standing in pools June 1 and 2, and August 11, 12, 19, 21, and 30, 1913.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Station is below all diversions. At times a small amount of seepage water from the St. Thomas district is returned to the river below the station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Rating curves poorly defined. Gage read to hundredths once daily. Discharge determined by shifting-control method. Records poor.

Discharge measurements of Muddy River near St. Thomas, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 16	Leonard Tanner	5.55	34.9
Apr. 5	L. W. Jordan	4.20	1.39
Sept. 3	Leonard Tanner	4.96	5.03

Monthly discharge of Muddy River near St. Thomas, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 16-31	35	32	34.1	1,080
January	350	27	77.2	4,750
February	94	3.1	61.6	3,540
March	256	4.1	20.5	1,260
April	7.3	.9	2.44	145
May	7.9	.5	2.74	168
June	2.2	.6	.933	55.5
July	74	.5	9.58	589
August	80	.2	12.7	781
September	10	.1	2.48	148
The period				12,500

GILA RIVER BASIN.

GILA RIVER AT GUTHRIE, ARIZ.

Location.—In sec. 3, T. 6 S., R. 30 E., about 1,500 feet above Arizona & New Mexico Railroad bridge at Guthrie, Greenlee County, and about 8 miles above junction of Gila and San Francisco rivers.

Drainage area.—Not measured.

Records available.—November 6, 1910, to September 30, 1916.

Gage.—Stevens water-stage recorder on left bank about 1,500 feet above railroad bridge, installed May 16, 1914, at datum different from that of inclined staff gage on right bank about 500 feet above railroad bridge, which was used prior to that date.

Discharge measurements.—Made from cable 1,000 feet below gage, or by wading.

Channel and control.—Sand and gravel; shifting at high stages. Semipermanent control at low stages.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 10.2 feet at 9 p. m. January 18 (discharge determined from extension of rating curve 7,600 second-feet); minimum discharge 36 [1] second-feet June 28 to July 7.

1910–1916: Maximum stage from water-stage recorder 11.4 feet at 7 p. m. December 20, 1914 (discharge determined from extension of rating curve 16,500 second-feet); minimum discharge 18 second-feet May 21, 1914.

Diversions.—Sufficient water to irrigate about 7,000 acres of land is diverted from stream above station.

Accuracy.—Stage-discharge relation not permanent because of shifting control. Nineteen discharge measurements made during the year, together with several made before October 1, 1915, and after September 30, 1916, were used to construct rating curves applicable as follows: October 1 to November 6, fairly well defined; November 7–14, poorly defined; December 11 to February 2, fairly well defined below 2,300 second-feet; February 2 to March 24, fairly well defined; March 25 to April 7, fairly well defined; April 8 to July 10 and July 19 to August 11, well defined; August 12 to September 30, fairly well defined between 500 and 900 second-feet. Operation of the water-stage recorder was satisfactory throughout the year except for short periods as indicated in the footnote to the daily-discharge table. Daily discharge ascertained by applying to the rating table daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage heights except for period of shifting control, when the shifting-control method was used. Records obtained by use of rating tables, fair; others roughly approximate.

Discharge measurements of Gila River at Guthrie, Ariz., during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	19	J. B. Spiegel	1.95	74	Apr.	8	J. B. Spiegel	3.54	508
	19	.....do	1.95	78		8	.....do	3.54	528
Nov.	15	.....do	2.10	111	June	11	.....do	1.80	54
	15	.....do	2.10	121		11	.....do	1.80	61
Dec.	10	.....do	2.15	113	July	13	.....do	1.82	82
	10	.....do	2.15	110		13	.....do	1.82	76
Feb.	3	.....do	4.47	1,200		19	Ellsworth and Spiegel	2.98	313
	3	.....do	4.44	1,190		19	.....do	2.90	274
Mar.	7	.....do	4.28	1,120	Sept.	7	J. B. Spiegel	3.74	523
	9	.....do	4.28	1,080		7	.....do	3.75	546

[1] No gage record July 8–12. Discharge may have been slightly less for a day or two during that period.

Daily discharge, in second-feet, of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	110	73	118	100	1,500	1,240	987	399	98	36	146	830
2	105	72	118			1,240	888	544	93	36	157	715
3	102	72	117		1,200	1,170	798	590	89	36	250	563
4	98	72	117		1,070	1,170	742	567	85	36	222	475
5	95	75	118		973	1,200	665	487	79	36	236	392
6	93	77	118	105	884	1,170	642	438	74	36	214	355
7	91	157	118	120	856	1,170	573	423	71	36	184	540
8	91	130	118		828	1,170	522	408	67	100	177	950
9	85	140	114		884	1,070	487	392	64		170	1,150
10	83	144	113		1,000	1,040	479	377	60		172	830
11	77	142	113		1,100	1,040	458	362	57		344	563
12	77	136	113		1,100	1,140	434	337	52		1,180	455
13	77	134	113		1,200	1,170	418	327	50	78	518	412
14	77	126	113		1,280	1,140	410	304	47	77	563	366
15	77	120	112		1,240	1,140	403	298	46	74	374	341
16	77	126	112		1,170	1,070	399	285	46	76	366	297
17	79	126	113		1,100	1,000	388	279	46	100	359	272
18	81	126	115	3,650	1,040	912	351	256	44		352	284
19	77	125	115	5,380	1,000	884	327	236	44	355	343	281
20	77	120	113	6,310	973	856	310	222	44	236	337	260
21	81	120	113	4,120	912	828	301	214	43	201	330	237
22	83	113	110	2,550	912	828	310	204	44	172	327	215
23	87	115	108	1,790	1,000	856	320	191	44	159	323	199
24	83	114	107	1,540	1,040	1,070	320	172	44	150	496	187
25	81	113	105	1,460	973	1,350	317	148	42	121	496	182
26	81	110	100	1,620	942	1,270	327	134	40	104	416	176
27	79	113		1,200	912	1,310	317	125	39	96	715	160
28	75	117		1,560	973	1,270	317	117	36	99	610	152
29	75	119		2,870	1,170	1,240	327	112	36	90	586	138
30	75	119		3,770	....	1,160	334	107	36	168	1,260	128
31	75	....		2,250	....	1,060	....	102	....	196	1,080	....

Note.—Gage height not recorded Dec. 26 to Jan. 5, Jan. 7–17, Feb. 1, 2, discharge estimated; May 7–10, discharge interpolated. Discharge July 8–12, 17, 18, estimated by comparison with records of flow at other stations. Gage heights used to determine discharge Aug. 15–23 corrected because of silt in well; possibly somewhat in error.

Monthly discharge of Gila River at Guthrie, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	110	75	84.0	5,160
November	157	72	115	6,840
December	118	....	111	6,820
January	6,310	....	1,350	83,000
February	....	828	1,060	61,000
March	1,350	828	1,100	67,600
April	987	301	462	27,500
May	590	102	295	18,100
June	98	36	55.3	3,290
July	355	....	110	6,760
August	1,260	146	429	26,400
September	1,150	128	404	24,000
The year	6,310	....	464	336,000

Note.—See footnote to daily-discharge table.

GILA RIVER NEAR SOLOMONVILLE, ARIZ.

Location.—In sec. 31, T. 6 S., R. 28 E., about a mile below intake of Brown canal and about 10 miles above Solomonville, Graham County.

Drainage area.—Not measured.

Records available.—April 21, 1914, to September 30, 1916.

Gage.—Stevens water-stage recorder on left bank, directly opposite J. W. Earven's ranch. Gurley water-stage recorder at same site and datum used from February 29 to August 4, 1916.

Discharge measurements.—Made from table just below gage or by wading near gage.

Channel and control.—Sand and fine silt. Control at low stages formed by rapids below the gage; shifts somewhat at all stages.

Extremes of discharge.—Maximum stage during the year, from flood marks on gage well, 14 feet about 5 p. m. January 19 (discharge, determined from extension of rating curve, 100,000 second); minimum stage, zero on gage June 21–28 (discharge 110 second-feet).

1914–1916: Maximum stage and discharge January 19, 1916; minimum stage, from water-stage recorder, 0.56 foot on June 29, 1914 (discharge 64 second-feet).

Diversions.—Brown canal, which heads about a mile above station, is used to irrigate a few hundred acres on the north side of the river. About 7,000 acres are irrigated from this stream above the station at Guthrie.

Accuracy.—Stage-discharge relation not permanent; numerous discharge measurements are necessary to define rating curves. Twenty-seven measurements were made during the year. These measurements, together with several made before October 1, 1915, and after September 30, 1916, were used to construct rating curves applicable as follows: October 1 to January 16, fairly well defined below 500 second-feet; January 17 to February 1 and May 18 to August 11, fairly well defined below 10,000 second-feet (extension of rating curve above 10,000 second-feet based largely on area-slope method and is roughly approximate); during the remainder of year the discharge was ascertained either from poorly defined rating curves or by indirect method for shifting control. The operation of the water-stage recorder was satisfactory throughout the year except for periods as indicated in the footnote to the daily-discharge table. Daily discharge for periods during which rating tables were applicable was ascertained by applying to the rating table daily gage heights determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging hourly gage heights. Records fair October 1 to February 1 and May 18 to August 11 for discharge below 10,000 second-feet, except for days of missing gage heights as indicated in footnote to daily-discharge table; other records poor.

Discharge measurements of Gila River near Solomonville, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	J. B. Spiegel	0.70	170	Mar. 31	J. B. Spiegel	1.77	2,760
12	.....do	.70	173	Apr. 14	.....do	.95	1,290
Nov. 22	.....do	.84	199	May 3	.....do	.97	1,400
22	.....do	.84	208	3	.....do	.95	1,300
Dec. 12	Jacob and Spiegel	.83	211	18	.....do	.58	460
Jan. 21	J. B. Spiegel	4.00	[a] 17,400	18	.....do	.58	455
22	.....do	3.15	9,170	July 11	.....do	.35	287
24	.....do	2.28	5,840	21	Ellsworth and Spiegel	.50	399
Feb. 7	.....do	1.50	1,860	21	.....do	.50	401
7	.....do	1.50	1,940	Aug. 5	J. B. Spiegel	.42	323
Mar. 7	.....do	1.90	2,700	5	.....do	.42	344
7	.....do	1.90	2,690	Sept. 11	.....do	1.06	1,460
15	.....do	1.95	2,980	11	.....do	1.02	1,430
15	.....do	1.93	2,940				

[a] Surface velocity observed for about one-half the discharge and coefficient of 0.90 used to reduce to mean velocity. Depths uncertain because of high velocities.

Daily discharge, in second-feet, of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	257	170	209	291	6,580	....	2,320	1,130	266	129	570	1,900
2	243	170	209	280	4,300	....	1,900	1,490	260	136	511	1,440
3	227	165	209	257	3,600	....	1,840	1,400	255	142	452	1,080
4	212	165	212	234	2,940	....	1,570	1,230	249	149	393	804
5	202	176	230	230	2,420	....	1,470	1,110	244	155	334	866
6	190	190	234	230	2,260	....	1,300	940	238	155	376	866
7	181	262	230	252	1,960	2,780	1,280	910	232	156	308	1,060
8	176	257	227	280	2,320	2,620	1,130	883	232	165	296	1,360
9	176	248	223	297	3,000	2,460	1,180	856	227	180	244	2,460
10	176	234	220	319	3,480	2,460	1,160	760	222	260	205	2,740
11	173	227	216	700	3,600	2,940	1,140	760	216	290	432	1,620
12	170	223	209	532	4,100	3,260	1,140	690	214	290	2,230	1,060
13	165	223	212	405	4,700	3,260	1,260	650	212	355	2,060	916
14	165	216	216	370	4,600	3,260	1,300	610	210	308	2,000	775
15	168	216	223	336	4,250	2,940	1,230	517	195	260	1,740	674
16	160	216	234	1,120	3,700	2,620	1,190	496	180	249	1,770	660
17	158	216	248	22,100	3,320	2,160	1,190	486	165	232	1,740	610
18	165	216	243	40,800	3,320	1,800	1,180	458	150	320	1,670	560
19	181	216	234	73,600	3,270	1,580	1,180	441	137	416	1,620	600
20	181	212	230	46,800	3,000	1,460	1,170	424	124	407	1,550	550
21	181	212	227	16,400	2,880	1,460	1,170	407	110	390	1,530	470
22	181	212	227	9,300	3,500	1,580	1,160	398	110	376	1,530	440
23	184	212	223	5,650	3,650	2,940	1,160	390	110	348	1,550	430
24	184	212	216	4,640	3,270	4,750	1,150	376	110	341	1,510	360
25	184	220	216	5,030	2,840	4,900	1,150	320	110	341	1,400	320
26	184	220	223	11,700	2,560	4,600	1,040	320	110	334	1,300	306
27	178	220	234	11,400	2,940	4,250	1,040	308	110	334	2,000	292
28	170	216	223	12,300	3,600	4,250	1,100	296	110	334	1,760	278
29	173	212	223	22,100	3,760	3,760	1,040	290	116	334	1,530	264
30	170	212	243	16,100	....	3,270	1,130	278	123	496	3,720	250
31	170	....	248	9,600	....	2,780	....	266	....	739	2,370	......

NOTE.—Mean daily gage heights Jan. 18–20 estimated from high-water marks observed by persons residing in the locality and from comparison with records obtained at other stations; gage heights Jan. 28 to Feb. 6 from daily reading of staff gage. Gage heights not recorded Mar. 1–6; discharge estimated, from study of records obtained at other stations on the Gila, at 3,000 second-feet. Gage heights either missing or unreliable, discharge interpolated, for the following days: Mar. 29, Apr. 8, 17–24, May 8, 9, June 2, 3, 12, 13, 29, 30, July 1–4, Aug. 2–4, 28, Sept. 26–30.

Monthly discharge of Gila River near Solomonville, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	257	158	183	11,300
November	262	165	212	12,600
December	248	209	225	13,800
January	73,600	230	10,100	621,000
February	6,580	1,960	3,440	198,000
March	4,900	1,460	2,970	183,000
April	2,320	1,040	1,280	76,200
May	1,490	266	642	39,500
June	266	110	178	10,600
July	739	129	294	18,100
August	3,720	205	1,310	80,600
September	2,740	250	867	51,600
The year	73,600	110	1,810	1,320,000

NOTE.—See footnote to daily-discharge table.

GILA RIVER NEAR SAN CARLOS, ARIZ.

Location.—One mile above dam site in box canyon on San Carlos Indian Reservation, and about 6 miles below San Carlos Indian Agency, Gila County.

Drainage area.—Not measured.

Records available.—April 29, 1914, to September 30, 1916, at present site; 1899 to 1905 at a point half a mile south of the Indian Agency at San Carlos and below San Carlos Creek; August 17, 1910, to February 5, 1911, at a point just below the Arizona Eastern Railroad bridge and half a mile above San Carlos Creek.

Gage.—Stevens water-stage recorder bolted to ledge on left bank. Gage was overtopped by flood of January 20, 1916, and put in operation again March 4, 1916.

Discharge measurements.—Made from cable about half a mile above gage or by wading near gage. Cable destroyed by flood of January 20, 1916, and not replaced during the year.

Channel and control.—Bed composed of sand, gravel, and boulders. A semipermanent control is formed by rapids over heavy boulders just below gage. Control shifts somewhat because of sand filling in and washing out from crevices between the boulders.

Extremes of discharge.—Maximum stage during year from highwater marks 25.5 feet, January 20, 1916 (discharge from extension of rating curve 92,000 second-feet); minimum stage, from water-stage recorder, 0.45 feet July 7 and 8 (discharge, 12 second-feet).

1914–1916: Maximum stage and discharge January 20, 1916; minimum stage, 0.15 foot July 1, 1914 (discharge, 1 second-foot).

Diversions.—Water to irrigate about 30,000 acres is diverted from river in the valley just above station. At times this diversion reduces flow at station practically to zero.

Accuracy.—Stage-discharge relation not permanent. Twenty-one measurements made during the year, together with a few made before October 1, 1915, and after September 30, 1916, were used to construct a rating curve fairly well defined below 15,000 second-feet, applicable November 20 to May 25 and August 1–24; other rating curves poorly defined. Daily discharge ascertained by shifting-control method or by applying to rating table daily gage height obtained from recorder graph or, during period January 16 to March 3, from one reading on staff gage to tenths on each of the following days: January 31, February 2, 4, 6, 8, 13, 21, and 24, Records fair except those for days on which discharge exceeded 15,000 second-feet or those obtained by shifting-control method or poorly defined rating curves. Interpolated determinations (see note to daily-discharge table) probably nearly as accurate as those based on gage readings, as study of weather records and records of flow obtained at other stations indicates that changes in flow were fairly uniform.

Discharge measurements of Gila River near San Carlos, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 16	J. B. Spiegel	1.15	62	July 22	Ellsworth and Spiegel	1.64	169
16	.....do	1.15	65	22	.....do	1.64	175
Nov. 19	.....do	.92	63	Aug. 2	J. B. Spiegel	2.08	321
19	.....do	.92	66	2	.....do	2.08	319
Dec. 13	Jacob and Spiegel	1.49	153	22	.....do	2.23	361
13	.....do	1.49	156	22	.....do	2.23	351
May 8	J. B. Spiegel	2.65	526	Sept. 13	.....do	3.89	1,060
8	.....do	2.65	504	13	.....do	3.87	958
25	.....do	1.50	163	28	.....do	1.60	133
25	.....do	1.50	160	28	.....do	1.60	139
July 7	.....do	.45	11.5				

Daily discharge, in second-feet, of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	164	26	130	417	9,010	....	2,410	656	121	16	359	1,480
2	142	27	130	424	5,420	....	2,270	770	118	15	313	1,120
3	120	27	180	436	4,420	....	2,140	968	109	14	267	913
4	114	27	....	406	3,430	3,140	2,000	916	101	14	255	747
5	108	28	....	406	2,990	2,830	1,860	794	87	13	272	656
6	102	32	....	387	2,550	2,660	1,720	700	83	12	287	656
7	96	75	....	463	2,340	2,600	1,580	598	80	12	212	747
8	90	82	....	424	2,140	2,600	1,450	525	80	12	195	1,060
9	84	82	....	413	2,400	2,500	1,310	521	77	14	175	1,410
10	78	82	....	891	2,660	2,390	1,170	475	74	190	144	2,670
11	72	82	....	1,050	2,910	2,330	1,050	444	72	87	156	1,950
12	65	75	....	866	3,170	2,440	995	432	70	127	475	1,410
13	65	69	146	916	3,430	2,600	916	506	68	110	1,770	1,040
14	65	69	156	770	3,360	2,660	942	387	66	93	1,730	794
15	66	69	181	723	3,300	2,440	942	376	50	93	1,730	679
16	66	65	186	....	3,230	2,330	916	356	50	82	1,450	565
17	61	65	204	....	3,160	2,180	794	349	48	67	1,110	....
18	57	65	230	....	3,090	2,050	723	319	43	59	842	....
19	53	65	250	....	3,020	1,970	700	293	40	50	731	....
20	49	69	270	....	2,960	....	664	270	35	67	620	....
21	45	82	278	....	2,890	....	624	247	34	97	509	....
22	41	85	281	....	2,970	....	589	222	31	173	398	....
23	37	85	281	....	3,060	....	568	202	30	163	376	....
24	33	85	258	....	3,140	....	589	181	31	150	380	....
25	29	83	258	....	....	5,210	589	160	23	150	656	....
26	29	82	225	....	....	4,600	580	154	23.	165	2,430	....
27	29	82	250	....	....	4,070	589	148	20	144	1,270	....
28	28	112	264	....	....	3,720	568	142	20	133	1,440	139
29	27	134	287	....	....	3,430	533	136	19	142	1,150	133
30	27	134	319	....	....	2,890	538	132	17	135	1,010	128
31	26	....	387	12,600	....	2,550	....	127	....	118	1,730	....

NOTE.—Gage heights missing or unreliable, discharge interpolated for the following days: Oct. 1, 2, 4–11, 13–15, 17–24; Feb. 1. 3, 5, 7, 9–12, 14–20, 22, and 23; April 1–9 and Aug. 19–21. Discharge estimated from study of records of flow at other stations and weather records, as follows: Dec. 4–12, 200 second-feet; Jan. 16–30, 25,000 second-feet; Feb. 25–29, 2,900 second-feet; Mar. 1–3, 3,700 second-feet; Mar. 20–24, 2,500 second-feet; Sept. 17–27, 300 second-feet. See "Accuracy" in station description.

Monthly discharge of Gila River near San Carlos, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	164	26	66.7	4,100
November	134	26	71.5	4,250
December	387	130	222	13,600
January	....	387	12,800	787,000
February	....	....	3,290	189,000
March	....	....	2,890	178,000
April	2,410	533	1,080	64,300
May	968	127	403	24,800
June	121	17	57.3	3,410
July	190	12	87.6	5,390
August	1,770	144	788	48,500
September	2,670	128	720	42,800
The year	....	12	1,890	1,370,000

NOTE.—See footnote to daily-discharge table.

GILA RIVER AT KELVIN, ARIZ.

LOCATION.—In sec. 12, T. 4 S., R. 13 E., about half a mile below the mouth of Mineral Creek, 1 mile below Kelvin,[1] Pinal County, and 25 miles above Florence, Ariz.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 26, 1911 to September 30, 1916.

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[1] Ray Junction on Arizona Eastern Railroad.

Gage.—Stevens water-stage recorder installed June 15, 1914, on left bank about half a mile above the original gage and referred to new datum. The original gage, an inclined staff fastened to basalt ledge on right bank opposite observer's house, was destroyed by the flood of March 8, 1911, and replaced by painting the graduations on the ledge a few feet downstream. November 23, 1911, an inclined staff for low water was fastened to the rock at the same location as first gage and on September 20, 1912, an auxiliary vertical staff for low water was installed on left bank opposite the inclined section. All gages previous to that now used referred to same datum.

Discharge measurements.—Made from suspension footbridge about 1½ miles above gage, or by wading near gage.

Channel and control.—Shifting sand. Semi-permanent control at new site.

Extremes of discharge.—Maximum stage during year, from flood marks on gage well 19.5 feet about noon January 20 (discharge, determined from extension of rating curve, 93,000 second-feet); minimum stage, from water-stage recorder, 1.76 feet, July 7 (discharge 29 second-feet).

1911–1916: Maximum discharge January 20, 1916; no flow June 29 to July 11, 1913.

Diversions.—About 30,000 acres are irrigated from Gila River between this station and Guthrie and about 7,000 acres above Guthrie.

Accuracy.—Stage-discharge relation not permanent. From the 42 discharge measurements made during the year, together with several measurements made before October 1, 1915, and after September 30, 1916, rating curves have been constructed applicable as follows: October 1 to January 15, well defined; January 16 to April 20, fairly well defined below 30,000 second-feet; May 1–14 and August 5 to September 7, well defined; September 12–30, fairly well defined. Operation of water-stage recorder satisfactory throughout year except for short periods indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table daily gage height obtained by inspecting gage-height graph, or for days of considerable fluctuation, by averaging hourly gage heights, except for periods for which shifting control method was used. Records obtained by use of rating tables good except those for high water of January, which are roughly approximate; other records fair.

Discharge measurements of Gila River at Kelvin, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	Jacob and Horton	2.02	185	Mar. 27	M. D. Anderson	4.30	3,450
12	Jacob, Jackson and Hall	1.83	97	27	.....do	4.30	3,410
29	J. B. Spiegel	1.80	68	Apr. 20[a]	J. B. Spiegel	2.90	877
29	.....do	1.80	72	20[a]	.....do	2.88	826
Nov. 27	.....do	1.89	119	May 1	M. D. Anderson	2.78	599
27	.....do	1.89	116	14	W. Adams	2.63	426
Jan. 12	.....do	2.60	810	14	.....do	2.65	446
12	.....do	2.65	932	14	M. D. Anderson	2.63	442
25	Anderson and Adams	5.87	7,500	14	.....do	2.65	400
Feb. 1	M. D. Anderson	6.05	7,220	June 27	.....do	1.86	58
2	.....do	5.42	5,460	27	.....do	1.86	57
2	.....do	5.35	5,390	July 14	Ellsworth and Anderson	2.31	220
3	.....do	4.85	4,100	Aug. 4	.....do	2.48	268
3	.....do	4.82	4,020	5	.....do	2.50	307
3	.....do	4.72	3,770	Sept. 7	C. E. Ellsworth	3.00	973
4	.....do	4.47	3,290	7	.....do	3.01	820
4	.....do	4.45	3,250	8	.....do	2.83	632
5	.....do	4.17	2,900	8[b]	.....do	3.25	1,180
5	.....do	4.15	2,830	8[c]	.....do	[d]6.00	[e]7,960
24	.....do	4.08	2,860	9[f]	.....do	4.05	3,210
24	.....do	4.07	2,770	25[f]	M. D. Anderson	2.15	261

Note.—Measurements Jan. 25 to Mar. 27 made from railroad bridge 2 miles below gage.

[a] Measured above Mineral Creek; discharge of Mineral Creek, 25.2 second-feet, measured and added.

[b] Measured above Mineral Creek; discharge of Mineral Creek, 25 second-feet, estimated and added.

[c] Measured above Mineral Creek; discharge of Mineral Creek, 100 second-feet, estimated and added.

[d] Mean gage height doubtful because of rapidly changing stage.

[e] Surface velocity observed; coefficient of 0.90 used to reduce to mean velocity.

[f] Measured above Mineral Creek; discharge of Mineral Creek, 40 second-feet, estimated and added.

Daily discharge, in second-feet, of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	381	74	206	980	8,200	3,760	1,960	605	180	47	442	1,340
2	318	74	178	830	5,820	5,120	1,870	725	170	39	463	1,150
3	283	74	185	637	4,480	3,540	1,650	876	165	34	463	850
4	258	74	214	761	3,540	2,920	1,530	915	160	34	344	689
5	221	74	292	699	2,920	2,460	1,400	915	155	34	297	653
6	178	127	352	637	2,620	2,320	1,370	788	150	32	725	641
7	178	172	372	562	2,320	2,320	1,300	689	145	29	390	750
8	178	172	326	562	2,230	2,320	1,300	629	140	34	344	2,310
9	165	178	309	506	2,230	2,320	1,220	550	135	53	289	3,020
10	153	191	300	1,060	2,520	2,320	1,120	550	130	182	258	3,230
11	122	172	309	1,290	2,720	2,140	1,150	494	125	318	265	1,840
12	90	159	401	830	2,720	2,230	1,220	494	120	228	484	1,580
13	90	146	401	761	2,920	2,320	1,120	442	115	360	1,660	1,100
14	95	127	401	692	3,230	2,420	1,110	411	110	259	1,750	890
15	106	111	421	1,210	3,320	2,420	1,150	390	105	200	1,660	778
16	111	111	411	4,000	3,120	2,230	1,120	390	100	207	1,940	688
17	106	122	411	17,300	2,720	2,140	1,020	362	95	194	1,120	662
18	95	122	401	25,800	2,620	2,050	950	362	90	169	928	650
19	90	127	440	42,200	2,520	1,820	854	334	85	244	629	579
20	90	127	401	76,200	2,420	1,780	878	316	80	259	572	510
21	85	146	381	....	2,520	1,780	860	316	75	510	442	456
22	74	159	381	....	2,420	1,960	850	297	70	345	344	402
23	71	172	381	....	2,520	2,720	850	258	70	375	297	354
24	71	159	372	....	2,820	4,440	820	250	65	325	463	307
25	67	133	352	7,030	2,720	4,230	835	245	65	273	850	264
26	68	133	352	8,200	2,520	3,880	770	240	60	421	1,750	265
27	65	127	372	13,100	2,320	3,220	795	230	59	390	1,410	229
28	74	127	381	18,100	2,420	2,920	780	220	59	494	1,260	213
29	74	206	391	23,900	2,920	2,820	760	210	56	442	1,120	178
30	74	236	401	16,800	....	2,520	635	190	53	381	915	157
31	74	....	472	12,300	....	2,140	....	180	....	316	1,490	......

NOTE.—Gage not working properly Dec. 28-30, discharge estimated by comparison with discharge of other stations; Jan. 5 and 13 discharge interpolated. Gage clock stopped Jan. 12 and started again in about 2 days. Jan. 20 crest of flood reached a maximum stage of about 19.5 feet and put the gage out of commission at a stage of 18.5 feet; gage heights Jan. 14-20 subject to slight error on account of uncertainty as to the exact time the gage clock was stopped. No gage-height record Jan 21-24; discharge for the period estimated at 24,000 second-feet, by comparison with record obtained near Solomonville. Gage heights, July 30 to Aug. 3 and Sept. 22-24 corrected on account of silt in well; may be slightly in error.

Monthly discharge of Gila River at Kelvin, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	381	65	132	8,120
November	236	74	138	8,210
December	472	178	354	21,800
January	76,200	506	12,000	738,000
February	8,200	2,230	3,050	175,000
March	5,120	1,780	2,700	166,000
April	1,960	635	1,110	66,000
May	915	180	448	27,500
June	180	53	106	6,310
July	510	29	233	14,300
August	1,940	258	818	50,300
September	3,230	157	891	53,000
The year	76,200	29	1,840	1,330,000

NOTE.—See footnote to daily discharge table.

GILA RIVER NEAR SENTINEL, ARIZ.

Location.—In sec. 10, T. 5 S., R. 9 W., 1 mile below old diversion dam of the Southwestern Arizona Fruit & Irrigation Co., about 10 miles north of Sentinel, Maricopa County.

Drainage area.—Not measured.

Records available.—July 1, 1913, to September 30, 1916.

Gage.—Vertical staff on left bank; read by J. T. Lee.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Shifting sand.

Extremes of discharge.—River dry part of each year at this point. The maximum stage on record occurred at 5 p. m. January 20, 1916, gage height 24.75 feet (discharge not determined).

Accuracy.—Stage-discharge relation not permanent because of constantly shifting control. Rating curve not developed. Gage read twice daily to hundredths from December 6 to January 19, and to half-tenths twice daily from March 5 to September 30. Daily discharge not determined.

No discharge measurements were made at this station during the year.

Daily gage height, in feet, of Gila River near Sentinel, Ariz., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	11.90	12.3	10.7	9.7	8.0	5.8	4.65	5.95	6.75
2	....	10.15	11.3	10.5	9.7	7.9	5.8	4.6	5.95	6.8
3	....	9.80	10.85	....	9.6	7.7	5.7	4.6	6.0	6.65
4	....	9.65	....	....	9.35	7.8	5.6	4.55	6.35	6.95
5	....	9.50	....	9.1	9.1	7.7	5.6	4.55	6.2	6.85
6	7.00	9.45	....	8.8	8.9	7.6	5.55	4.5	6.0	6.8
7	7.08	9.50	....	9.3	8.75	7.5	5.5	4.5	5.85	6.65
8	7.19	9.50	....	9.75	8.6	7.5	5.5	4.45	5.65	8.15
9	7.26	9.45	....	9.4	8.6	7.45	5.45	4.4	5.45	8.5
10	7.40	9.45	....	9.25	8.85	7.3	5.4	....	5.25	11.1
11	7.45	9.45	....	9.4	8.55	7.15	5.3	....	5.05	9.5
12	7.43	9.55	....	9.5	8.4	7.05	5.25	4.6	5.5	8.55
13	7.41	9.85	....	9.6	8.3	6.9	5.25	4.65	5.15	8.35
14	7.40	9.80	....	9.6	8.3	6.9	5.2	4.55	4.95	8.15
15	7.46	9.60	....	9.65	8.5	6.8	5.2	4.5	4.9	8.05
16	7.53	9.75	....	9.75	8.6	6.65	5.1	4.4	4.8	7.9
17	7.60	10.9	....	9.6	8.8	6.6	5.05	....	4.8	7.85
18	7.71	15.55	....	9.5	8.75	6.65	5.0	....	6.75	7.6
19	7.75	17.0	....	9.3	8.45	6.5	5.0	....	6.9	7.35
20	7.76	24.75	....	9.25	8.3	6.4	4.9	....	6.8	7.2
21	7.78	22.3	....	9.1	8.3	6.3	4.8	....	6.7	7.1
22	7.80	....	....	9.0	8.1	6.4	4.75	....	6.6	7.1
23	7.82	....	11.2	10.7	8.1	6.25	4.9	....	6.4	6.9
24	7.84	....	10.95	11.4	8.15	6.1	5.0	....	6.4	6.75
25	7.84	....	....	11.8	8.15	6.1	4.85	....	6.35	6.6
26	7.84	....	10.4	11.2	8.15	6.1	4.8	....	6.3	6.5
27	7.84	....	....	11.1	7.95	6.05	4.75	....	6.25	6.35
28	7.86	....	....	10.85	8.2	6.0	4.7	....	6.25	6.3
29	7.90	21.05	10.3	10.5	8.05	5.95	4.7	....	6.2	6.2
30	8.30	18.3	....	10.35	7.95	5.9	4.7	....	6.2	6.2
31	8.93	14.7	....	9.95	....	5.85	....	5.7	6.9	....

Note.—Gage and cable washed out by flood Jan. 20; gage replaced at about same datum Mar. 6; records from Jan. 20 to Mar. 5 obtained from temporary gages set by observer. Gage heights Mar. 20 and 29 maximum for the day. No readings on days for which gage heights are missing, except July 10, 11, and 17–30, when stream was dry.

SAN FRANCISCO RIVER AT CLIFTON, ARIZ.

Location.—In sec. 30 T. 4 S., R. 30 E., between highway bridge and railroad bridge at Clifton, Greenlee County, 1½ miles below diversion dam of the Arizona Copper Co. and about 5 miles above junction with Gila River.

Drainage area.—Not measured.

Records available.—October 24, 1910, to January 14, 1911; January 24 to March 31, 1912; and August 5, 1912, to September 30, 1916.

Gage.—Stevens water-stage recorder with inclined well on right bank about 1,000 feet below highway bridge, installed June 11, 1916, at datum different from that of gages previously used. Original gage, read from October 24, 1910, to September 30, 1912, was a vertical staff attached to highway bridge; replaced October 1, 1912, by a chain gage set at the same datum and read until August 5, 1913. From August 6, 1913, to May 14, 1914, a vertical staff on railroad bridge was used. On May 15, 1914, this was replaced by a Stevens water-gage recorder, which was set at the same datum and was used until January 19, 1916, when it was destroyed by flood. From January 20 to April 7, 1916, the staff gage on railroad bridge was read. From April 8 to June 10, 1916, the staff gage now used in connection with the present water-stage recorder was read. The gages on the railroad bridge were referred to a datum different from that of the gages on the highway bridge.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Banks high and steep and not likely to be overflowed except at extreme floods. Bed composed of sand and gravel. Control at old station constantly shifting; at new station fairly permanent except during high water, when it shifts slightly.

Extremes of discharge.—Maximum stage during year, from flood marks at gage, 16.8 feet, about 2 p. m. January 19 (discharge not determined); minimum stage, from water-stage recorder, 3.10 feet June 20 to July 8 (discharge 40 second-feet).

1910–1916: Maximum stage same as for 1916 (see above); minimum stage recorded, 2.6 feet, July 3, 6, and 7, 1913 (discharge 5.0 second-feet).

Diversions.—Small amount of water is used for irrigation above station.

Accuracy.—Stage-discharge relation not permanent. Numerous discharge measurements necessary to define rating curves. By means of the 19 measurements made during the year, together with several measurements made before October1, 1915, and after September 30, 1916, rating curves have been constructed applicable as follows: November 14 to December 10, fairly well defined; March 9–22, fairly well defined; March 23 to April 7, poorly defined; April 8 to September 30, well defined between 70 and 400 second-feet and fairly well defined above 400 second-feet. Staff gage read to tenths twice daily. Mean daily gage height obtained by inspecting water-stage recorder graph, except during periods of rapidly-changing stage, when hourly gage heights were averaged. Daily discharge ascertained by applying daily gage height to rating tables except for short periods, as indicated in footnotes to daily-discharge table. Records good since installation of new gage, April 8, except for short periods when silt in well prevented gage from working properly. Records from old gage fair for periods covered by rating tables; other records poor.

Discharge measurements of San Francisco River at Clifton, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	J. B. Spiegel	5.50	101	Apr. 7	J. B. Spiegel	[a] 4.70	724
19	.....do	5.50	99	June 13	.....do	3.25	70
Nov. 13	.....do	5.60	103	13	.....do	3.25	76
13	.....do	5.60	112	July 14	.....do	3.61	141
Dec. 9	Jacob and Spiegel	5.55	96	14	.....do	3.61	159
Feb. 4	J. B. Spiegel	5.90	1,040	19	Ellsworth and Spiegel	3.62	143
4	.....do	5.90	1,010	19	.....do	3.62	140
Mar. 10	.....do	6.10	1,440	Sept. 6	J. B. Spiegel	4.08	359
10	.....do	6.10	1,430	6	.....do	4.06	349
Apr. 7	.....do	[a] 4.70	728				

[a] New gage; gage on railroad bridge read 5.80.

Note.—Stage of measurements Oct. 19 to Mar. 10 read on gage on railroad bridge.

Daily discharge, in second-feet, of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	100	55	65	......	......	1,400	635	112	40	179	355
2	100	55	65	......	......	1,180	595	100	40	179	355
3	100	55	65	......	......	1,090	525	88	40	179	355
4	100	65	65	1,030	......	900	525	75	40	179	355
5	95	65	90	......	......	660	525	88	40	179	355
6	70	65	90	......	......	810	595	75	40	179	330
7	95	120	90	......	......	600	525	75	40	179	380
8	95	120	90	......	......	595	525	75	40	179	340
9	95	120	90	......	1,350	595	492	75	48	179	546
10	120	90	90	......	1,750	560	492	75	80	179	1,120
11	75	90	......	......	2,050	635	492	75	179	189	704
12	75	90	......	......	1,900	635	460	67	245	432	621
13	75	90	......	......	1,750	675	355	63	225	1,410	535
14	75	120	......	......	1,750	595	305	59	161	990	453
15	75	90	......	......	1,900	560	305	55	152	355	369
16	100	90	......	......	1,600	595	355	55	134	432	285
17	100	90	......	......	1,350	560	355	55	164	285	265
18	100	90	......	......	1,250	560	305	55	245	277	265
19	100	90	......	......	1,250	595	355	48	167	265	237
20	100	90	......	......	1,350	525	305	40	180	265	219
21	100	65	......	......	1,350	595	305	40	189	265	201
22	100	90	......	......	1,470	525	305	40	176	265	183
23	100	65	......	......	2,850	595	355	40	170	265	165
24	100	65	......	......	2,450	525	305	40	161	265	148
25	100	65	......	......	2,100	595	245	40	158	265	131
26	80	65	......	......	1,650	560	205	40	158	405	120
27	80	65	......	......	1,530	595	185	40	179	405	125
28	80	65	......	......	1,950	525	155	40	197	355	125
29	80	65	......	......	1,530	595	140	40	185	405	125
30	80	65	......	......	1,400	675	125	40	182	990	125
31	80	65	......	......	1,300	......	125	......	182	380	......

NOTE.—Discharge Oct. 1 to Nov. 13 computed by shifting-control method. Gage not working July 6–8; discharge estimated; Aug. 14–18 and Aug. 20 to Sept. 1 gage heights corrected because of silt in well and may be slightly in error. Sept. 12–15 and 20–24, silt in well; discharge interpolated, believed to be fairly accurate.

Monthly discharge of San Francisco River at Clifton, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	120	70	91.1	5,600
November	120	55	80.5	4,790
December 1-10	90	65	80.0	1,590
March 9-31	2,850	1,250	1,690	77,100
April	1,400	525	670	39,900
May	635	125	370	22,800
June	112	40	60.3	3,590
July	245	40	137	8,420
August	1,410	179	353	21,700
September	1,120	120	330	19,600

NOTE.—See footnote to daily-discharge table.

SAN PEDRO RIVER NEAR FAIRBANK, ARIZ.

Location.—Opposite Boguillas Land & Cattle Co.'s ranch house, 1½ miles south of Fairbank, Cochise County, and 3 miles below old Charleston mill.

Drainage area.—Not measured.

Records available.—September 28, 1912, to September 30, 1916. January 27, 1904, to August 31, 1906, and October 18, 1910, to November 15, 1911, for station at Charleston. November 16, 1911, to September 28, 1912, for station at diversion dam of Boguillas Land & Cattle Co.

Gage.—Vertical and inclined staff on right bank; read by J. M. Barnes. Original gage, which was a vertical staff on right bank about 800 feet below present site, was installed September 28, 1912, destroyed by flood August 17, 1914, and replaced at same datum August 24, 1914; the second gage was washed out December 23, 1914, and replaced by present gage at independent datum January 21, 1915.

Discharge measurements.—Made by wading near gage or from cable 600 feet below gage.

Channel and control.—Sand, gravel, and clay; likely to shift slightly at low stages and considerably at high stages.

Extremes of discharge.—Maximum stage recorded during year, 5.7 feet at 9 p. m., August 16 (discharge, determined from extension of rating curve, 4,200 second-feet); minimum discharge, 2 second-feet, on several days during October, November, April, June, July, and September.

1912–1916: Maximum stage recorded, 16 feet at 5 p. m., December 22, 1915 (discharge not determined); minimum discharge, 1.7 second-feet June 26 to July 8, 1913.

Diversions.—The Boguillas Land & Cattle Co. diverts water at various points above station for irrigation. Total area irrigated not known.

Accuracy.—Stage-discharge relation not permanent. The 19 measurements made during the year, together with several high-water measurements made after September 30, 1916, were used to construct a standard rating curve fairly well defined for all stages and applicable January 21 to July 9 and August 9 to September 30. Gage read to half-tenths twice daily. Daily discharge ascertained by applying gage height to rating table or by shifting-control method. Records fair for periods covered by rating curve; other records roughly approximate.

Discharge measurements of San Pedro River near Fairbank, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. B. Spiegel	0.60	[a] 3.0	Apr. 24	J. B. Spiegel	0.40	7.2
Nov. 12	.....do	.78	10.6	24	.....do	.40	7.3
12	.....do	.78	10.0	July 25	Ellsworth and Spiegel	.71	18.9
Dec. 8	Jacob and Spiegel	.81	20.4	25	.....do	.71	19.3
8	.....do	.81	21.6	Aug. 9	J. B. Spiegel	.50	10.0
Jan. 1	J. B. Spiegel	.78	21.4	9	.....do	1.40	241
1	.....do	.78	19.5	9	.....do	1.50	291
Feb. 19	.....do	.65	17.8	10	.....do	1.01	99
19	.....do	.65	20.9	10	.....do	.99	83
Mar. 22	.....do	.55	[a] 10.0				

[a] Estimated.

Daily discharge, in second-feet, of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	35	3	21	19	60	10	12	16	3	2	34	32
2	35	2	21	17	50	10	11	16	3	2	28	25
3	35	3	17	17	32	10	10	13	3	2	28	16
4	28	4	17	17	25	10	10	10	3	2	28	25
5	28	5	21	17	25	10	9	10	3	2	88	16
6	28	6	17	17	25	10	8	8	3	2	60	16
7	28	35	17	17	25	10	7	6	3	2	60	1,070
8	21	35	17	17	25	10	7	6	3	3	10	340
9	21	21	21	17	20	10	6	6	3	3	60	60
10	21	21	21	17	20	10	6	4	3	595	120	60
11	21	12	21	17	20	10	6	4	3	980	1,200	16
12	12	12	21	17	20	10	6	4	3	340	138	8
13	12	12	21	17	16	10	6	10	3	97	315	6
14	12	12	21	13	16	10	6	10	3	82	60	4
15	12	12	21	13	16	10	6	4	3	97	400	3
16	12	12	21	13	20	10	6	10	3	44	1,760	3
17	12	12	21	13	20	10	6	4	3	630	290	3
18	12	12	21	13	20	10	6	4	3	230	120	3
19	9	19	21	17	20	10	6	4	3	97	40	3
20	6	25	21	340	20	10	6	3	3	400	40	3
21	4	25	17	400	20	10	6	3	3	67	40	3
22	3	25	17	340	20	10	6	8	2	29	32	3
23	2	25	17	240	10	25	6	8	2	44	40	3
24	2	25	17	195	10	16	6	4	2	44	32	3
25	2	37	17	130	10	16	6	3	2	260	88	2
26	2	37	17	138	10	16	6	3	2	44	40	2
27	2	37	17	195	10	15	6	3	2	36	60	2
28	2	37	13	138	10	14	6	3	2	29	155	2
29	2	37	13	88	10	14	2	3	2	30	120	2
30	2	23	13	74	....	13	2	3	2	31	88	2
31	2	....	17	74	....	12	....	3	....	32	32	....

NOTE.—Gage heights missing, discharge interpolated, Nov. 4, 5, and 14; Jan. 4–6; Mar. 17, Mar. 27 to Apr. 8; May 28; June 17–19 and 27–29; July 27 and 29–31.

Monthly discharge of San Pedro River near Fairbank, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	35	2	13.7	842
November	37	2	19.4	1,150
December	21	13	18.5	1,140
January	400	13	85.4	5,250
February	60	10	20.9	1,200
March	25	10	11.6	713
April	....	2	6.6	393
May	16	3	6.3	387
June	3	2	2.7	161
July	980	2	137	8,420
August	1,760	10	181	11,100
September	1,070	2	57.9	3,450
The year	1,760	2	47.2	34,200

QUEEN CREEK NEAR SUPERIOR, ARIZ.

LOCATION.—Below dam site near Whitlow's ranch and about 12 miles below Superior, Pinal County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 14, 1915, to September 30, 1916.

GAGE.—Inclined staff on left bank 1 mile below dam site; installed September 15, 1916; read by W. C. Mullins. Original gage was installed February 14, 1915, was a vertical staff painted on rock ledge on right bank at lower end of box canyon about 500 hundred feet above Whitlow's ranch house; gage was read until October 17, 1915, when it was replaced by an inclined staff on left bank about 700 feet upstream, at a different datum. On March 30, 1916, a vertical staff was installed at practically the same site as the original gage but at a datum 1.65 feet higher. August 6, 1916, this gage was replaced by an inclined and vertical staff, at the same site and datum, which was read until September 15, 1916, when present gage was installed 1 mile below at a different datum.

Discharge measurements.—Made from cable at dam site, or by wading.

Channel and control.—At dam site the channel is confined between high rocky banks about 300 feet apart. At the present site of gage the left bank is likely to be overflowed at extremely high stages. Bed of stream composed of constantly shifting sand and gravel.

Extremes of discharge.—Maximum stage recorded during year, 8.0 feet at 12 noon January 28 (discharge not determined); stream channel dry during part of each year at present site of gage; at dam site the flow is probably never less than about 1 second-foot.

Diversions.—Water is diverted above gage to irrigate a few acres; amount not known.

Accuracy.—Stage-discharge relation not permanent. One poorly defined rating curve used October 1 to March 23; shifting-control method used during rest of year. Gage read to hundredths twice daily. Records roughly approximate. Determinations of daily discharge not sufficiently accurate to warrant publication.

Discharge measurements of Queen Creek near Superior, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	Anderson and Guthrie.	1.00	1.7	Aug. 4	Ellsworth and Anderson.	0.72	2.8
Jan. 19	C. C. Jacob	3.90	533	6	C. E. Ellsworth	.74	2.7
20	.....do	3.00	261	6	.....do	.78	2.5
21	.....do	3.20	334	Sept. 15	.....do	[a]1.68	2.3
Mar. 30	M. D. Anderson	.82	25.0	29	W. C. Mullins	[a]1.66	1.2
Aug. 4	Ellsworth and Anderson.	.72	2.8				

[a] Referred to gage about 1 mile below dam site installed Sept. 15, 1916.

Monthly discharge of Queen Creek near Superior, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3	2	2.2	135
November	2	2	2.0	119
December	500	2	19	1,170
January	960	26	239	14,700
February	220	22	47	2,700
March	255	10	40	2,460
April	20	3	8.8	524
May	4	2	2.9	178
June	....	....	2.5	149
July	24	....	4.6	283
August	340	3	26	1,600
The period	960	....	36.0	24,000

Note.—See "Accuracy" in station description. No gage record Mar. 24-29; discharge estimated at 75 second-feet. Discharge Apr. 27 and 28 and May 23-26 interpolated. Discharge June 1 to July 26 estimated at 2.5 second-feet; rating table not applied because of constantly shifting control and insufficient discharge measurements. During this period there was practically no rainfall in the basin and the stream remained at a uniformly low stage. Discharge Sept. 1-5 estimated at 3.5 second-feet; Sept. 15-30, 1.3 second-feet. No gage-height record Sept. 6-14; considerable flood during this period and no data available to estimate the flow.

SANTA CRUZ RIVER NEAR NOGALES, ARIZ.

Location.—Just below proposed dam site on Yerba Buena ranch, half a mile above city pumping plant and about 7 miles northeast of Nogales, Pima County.

Drainage area.—Not measured.

Records available.—March 22 to November 30, 1907; April 1, 1909, to September 30, 1916 (incomplete).

Gage.—Richard Frères water-stage recorder on left bank about half a mile above city pumping plant; installed January 3, 1916. Original gage, a vertical staff on right bank about 500 feet below the intake of a small irrigation ditch and about one-fourth mile above the present gage, was used until January 18, 1912, when a Richard Frères water-stage recorder was installed at the same site as present gage. This gage was used until December 18, 1914, when it was replaced by a Stevens water-stage recorder that was used until March 13, 1915, A vertical staff on right bank at pumping plant was read from March 13 to December 4, 1915. During the interval December 4, 1915, to January 3, 1916, all readings were made on the staff gage attached to the present gage well. Gage elevations have been as follows: original gage and gage at pumping plant at different elevations and no relation to other gages; Stevens recorder and present Richard Frères recorder at approximately the same datum, which is 1.3 feet higher than that of the first Richard Frères recorder installed January 18, 1912.

Discharge measurements.—Made by wading.

Channel and control.—Shifting sand. Banks fairly clean; subject to overflow during high stages.

Extremes of discharge.—Stream is dry during a part of each year. No dependable records of extreme floods available.

Diversions.—Water is diverted above the station for the irrigation of about 140 acres.

Accuracy.—Stage-discharge relation not permanent. Rating curves have been constructed applicable as follows: October 1 to December 4, based on two measurements made prior to September 30, 1915, poorly defined; January 4 to February 20 and July 26 to September 30 fairly well defined below 50 second-feet. Staff gage read twice daily to half-tenths. Daily discharge, which is not considered sufficiently accurate to warrant publication, was ascertained by applying daily gage height to rating table or by shifting-control method. Operation of water-stage recorder not satisfactory because of lack of sensitiveness at low stage and excessive deposits of sand and silt on float well. Records liable to considerable error, particularly for periods during which shifting-control method was used.

Discharge measurements of Santa Cruz River near Nogales, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	J. B. Spiegel	....	0.0	Mar. 23	J. B. Spiegal	1.73	26.8
Dec. 7	Jacob and Spiegel	1.15	9.0	23	.....do	1.73	27.0
7	J. B. Spiegel	1.15	10.0	Apr. 23	.....do	1.63	6.5
Jan. 3	.....do	1.49	20.6	23	.....do	1.63	6.6
3	.....do	1.49	20.0	July 26	Ellsworth and Spiegel	1.47	12.4
Feb. 20	.....do	1.75	48.5	26	.....do	1.47	14.1
20	.....do	1.75	46.3	Aug. 11	J. B. Spiegel	1.55	24.0

Note.—All gage heights refer to datum of Richard Frères recorder installed Jan. 3, 1916.

Monthly discharge of Santa Cruz River near Nogales, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8	0	0.26	16
November	27	0	16.2	964
December	60		26.4	1,620
January	100	14	44.3	2,720
February	55	29	40.2	2,310
March			29.2	1,800
April			13.5	803
May	12	2	4.9	301
June	7	1	2.7	161
August	55	10	23.5	1,440
September	29	4	7.6	452

NOTE.—See "Accuracy" in station description. Stream dry Oct. 2 to Nov. 6. No gage-height record Dec. 5, 6, 17–19, 21–26, Dec. 28 to Jan. 2, Jan. 4 and 5; discharge interpolated. No gage-height record Dec. 8-15 and Mar. 24 to Apr. 22; discharge estimated. Several small floods occurred during July, but gage height available are insufficient to determine discharge.

SANTA CRUZ RIVER AT TUCSON, ARIZ.

LOCATION.—In sec. 13, T. 14 S., R. 13 E., at Congress Street Bridge in Tucson, Pima County.

RECORDS AVAILABLE.—October 15, 1905, to September 31, 1916; incomplete.

DRAINAGE AREA.—Not measured.

GAGE.—Staff on bridge pier installed September 7, 1916; read by J. O. Kenny. Original gage was painted on bridge pier on left bank. During 1911 and up to September 30, 1912, gage heights were observed from temporary staff or by measuring to the water surface from a reference point on the bridge. October 1, 1912, to July 7, 1913, a chain gage installed on the bridge was used. Original datum was maintained until November 22, 1913, when it was lowered 2 feet. From December 12, 1914, to September 7, 1916, gage heights were obtained from a reference point whose elevation, until the flood of January, 1916, was 19.28 feet above new datum. During the flood in January the bridge settled, lowering the reference point to 16.73 feet above datum. During the summer of 1916 a new bridge was constructed and the present gage was installed September 7 on one of the piers at a different datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand; shifting.

EXTREMES OF DISCHARGE.—Stream dry part of each year at this point. On December 24, 1914, the maximum gage height was 9.8 feet, indicating a discharge of about 9,000 second-feet, which was probably the maximum ever recorded at the station.

ACCURACY.—Cooperating party states that the records are good.

COOPERATION.—Records furnished by University of Arizona through G. E. P. Smith, irrigation engineer.

Discharge measurements of Santa Cruz River at Tucson, Ariz., during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	23	J. B. Spiegel		0	July	31	Wilson and Atchley	1.05	290
Nov.	10	do		0	Aug.	1	C. P. Wilson	.70	25
Jan.	20	Moots and Wilson	2.31	2,000		2	do	.50	5
	22	Moots and Luis	2.40	2,110		8	do	.60	7
	24	Moots and Phelps	1.00	274		11	do	1.08	184
	28	Moots and Gray		217		12	do	1.28	436
	29	Wilson and Steinneger	1.08	246		13	do		166
Feb.	2	Enger and Pickrell	.58	17		14	do	.88	100
July	14	C. P. Wilson	.75	16		15	Wilson and Hall	1.45	810
	20	Wilson and Herndon	1.10	348		16	do	1.32	932
	20	do	.87	229		16	do	1.22	760
	26	C. P. Wilson	.97	187		24	C. P. Wilson	1.10	210
	26	do	.45	63	Sept.	7	A. L. Enger	2.60	21
	27	Wilson and Jose	1.47	600		8	do	3.90	608
	27	do	1.37	620		8	do	4.00	642
	28	C. P. Wilson	.82	135		11	C. P. Wilson	2.83	73
	28	do	.90	159					

NOTE.—New gage installed at a different satum Sept. 7, 1916.

Monthly discharge of Santa Cruz River at Tuzson, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
January	4,000	0	399	24,500
February	100	0	10.2	587
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	0	0	0	0
July	256	0	43.9	2,700
August	1,380	0	113	8,180
September	308	0	22.3	1,330
The year	4,000	0	51.4	37,300

NOTE.—Monthly discharge computed by engineers of the United States Geological Survey.

RILLITO CREEK NEAR TUCSON, ARIZ.

LOCATION.—In sec. 23, T. 13 S., R. 13 E., at highway bridge on Oracle Road, 4 miles north of Tucson, Pima County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—1909 to September 30, 1916; incomplete.

GAGE.—Richard Frères water-stage recorder on right abutment of the bridge. Staff gage readings were also made at frequent intervals during flood times.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand, wide and shallow; badly shifting at all stages.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year about 4,900 second-feet January 20; maximum mean daily discharge since station was established about 16,000 second-feet December 23, 1914. Stream dry the greater part of each year.

ACCURACY.—Cooperating party states that records are good.

COOPERATION.—Records furnished by University of Arizona through G. E. P. Smith irrigation engineer.

Discharge measurements of Rillito Creek near Tucson, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 17	Enger and Luis	4.58	227
17	.....do	4.57	242
17	.....do	4.56	188
18	F. A. Luis	4.60	187
19	Smith and Wilson	6.35	6,630
21	Moots and Luis	5.45	1,050
23	.....do	5.04	384
24	Moots and Phelps	5.17	289
27	Moots and Feucht	5.01	307
29	Moots, Jones, and Hedgpeth	5.55	1,950
Feb. 5	A. L. Enger	4.30	53
6	Enger and Pickrell	4.20	29.5
11	.....do	4.30	63
14	.....do	4.20	35.0
18	Pickrell and Wikoff	4.10	10.3
21	Spiegel and Enger	4.08	7.0
Mar. 1	W. W. Pickrell	4.70	326
3	.....do	4.40	108
7	.....do	4.20	60
24	A. L. Enger	4.55	180
26	W. W. Pickrell	4.40	117
29	.....do	4.30	43.0
Apr. 16	F. J. McSherry	3.90	9.9
July 20	C. P. Wilson	4.88	153
20	.....do	4.50	79
28	.....do	4.27	142
Aug. 10	.....do	3.75	14
12	.....do	4.23	201
14	.....do	4.40	327
15	Wilson and Meserve	4.55	419
16	C. P. Wilson	4.10	67
Sept. 10	Enger and Schrymer	4.25	38

Monthly discharge of Rillito Creek near Tucson, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0	0	0.0	0
November	0	0	.0	0
December	0	0	.0	0
January	4,900	0	603	37,100
February	200	5	38.3	2,200
March	330	0	58.5	3,600
April	6	0	1.0	60
May	0	0	.0	0
June	0	0	.0	0
July	206	0	14.8	910
August	798	0	126	7,750
September	175	0	11.5	684
The year	4,900	0	72.0	52,300

NOTE.—This table computed by engineers of United States Geological Survey. Stream dry Oct. 1 to Jan. 15, Mar. 15–23, Apr. 4–15, Apr. 19 to July 10, July 13–18 and 21–25, July 29 to Aug. 8, Aug. 17–22, Aug. 26 to Sept. 7, and Sept. 11–30.

BLACK RIVER NEAR FORT APACHE, ARIZ.

LOCATION.—Just above bridge on highway from Rice to Fort Apache, 1½ miles above junction with White River and 18 miles west of Fort Apache, Gila County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 24, 1912, to September 30, 1916; incomplete.

GAGE.—Original vertical staff on right bank about 400 feet above bridge used November 24, 1912, to October 16, 1913, and after May 11, 1916. A Gurley water-stage recorder on left bank about three-quarters of a mile below site of present gage and at a different datum was used from October 16, 1913, to Desember 19, 1914, when it was damaged by flood; from January 20, 1915, to January 8, 1916, the staff gage on the float well was read.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed at site of upper gage, sand and gravel; control, solid rock. Bed and control at lower gage, sand and gravel; fairly permanent at low stages but shifting at high stages.

EXTREMES OF DISCHARGE.—Maximum and minimum stages during year not determined.

1912–1915: Maximum stage, from flood marks, 15.9 feet December 20, 1915 (discharge, determined from extension of rating curve, 18,000 second-feet); minimum discharge, 61 second-feet, June 27 to July 2, 1914.

Diversions.—None above gage.

Accuracy.—Stage-discharge relation permanent at upper gage; shifting during high stages at lower gage. Rating curve used October 1 to January 8 fairly well defined between 140 and 200 second-feet; that used May 12–29 and September 3–30 fairly well defined below 220 second-feet. Gage read to half tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Gage height subject to considerable error. Records roughly approximate. Daily discharge not sufficiently accurate to warrant publication.

Discharge measurements of Black River near Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 19	Ellsworth and Spiegel	7.21	216
22	J. B. Spiegel	7.09	163
22	.....do	7.09	160

Monthly discharge of Black River near Fort Apache, Ariz., for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	100	80	91.9	5,650
November	208	93	140	8,330
December	100	80	88.9	5,470
January 1–8	122	100	108	1,710
May 12–29	480	173	305	10,900
September 3–30	540	173	326	18,100

Note.—No gage-height record Jan. 1, Jan. 9 to May 11, and May 30 to Sept. 2. Discharge Jan. 1 interpolated. See "Accuracy" in station description.

SALT RIVER NEAR ROOSEVELT, ARIZ.

Location.—At diversion dam for power canal, about 10 miles above upper end of Roosevelt reservoir and about 20 miles east of the town of Roosevelt, Gila County.

Drainage area.—4,222 square miles (measured by United States Reclamation Service).

Records available.—October 1, 1913, to September 30, 1916.

Gage.—Vertical staff on left bank bolted to concrete wall at head of canal. Temporary gages are used from time to time when channel shifts away from main gage.

Discharge measurements.—Made from cable at or by wading near dam site. Previous to January 19, 1916, when the dam was destroyed by flood, low-water measurements were made by wading below dam; when river could not be waded discharge was computed from elevation of water surface in reservoir, known outflow, and computed inflow from other than Salt River sources.

Channel and control.—Shifting sand and gravel. Prior to its destruction by flood January 19, 1916, the dam formed a permanent control.

Extremes of discharge.—Maximum mean daily discharge during year, 79,237 second-feet January 19; minimum discharge, 286 second-feet October 14, 15.

1913–1916: Maximum discharge January 19, 1916; minimum discharge, 164 second-feet June 29, 1914.

Diversions.—None.

Accuracy.—Previous to January 19, 1916, discharge was computed by considering dam as a weir, the coefficient of discharge having been determined by current-meter measurements; discharge after January 19, when dam was destroyed by flood, determined from current-meter measurements made nearly every day. Records reported as good by U. S. Reclamation Service.

Cooperation.—Daily-discharge record furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	412	295	339	745	10,878	6,510	5,520	3,322	988	480	630	1,170
2	360	289	339	562	9,524	7,120	5,047	3,262	983	470	645	950
3	344	289	339	515	6,198	8,165	4,606	2,884	993	450	530	849
4	330	289	339	478	3,532	8,100	5,201	2,924	900	430	517	746
5	329	289	339	421	2,573	5,733	3,572	2,317	866	430	475	677
6	312	309	390	446	2,688	5,610	4,010	1,959	900	430	435	933
7	312	375	399	770	2,680	4,995	3,968	2,131	930	430	425	780
8	312	446	399	820	2,646	5,306	3,659	2,242	967	430	465	736
9	296	472	399	834	3,536	4,483	3,651	2,157	940	420	400	849
10	296	461	390	1,110	4,586	4,697	3,585	1,814	955	500	415	3,340
11	296	498	390	3,153	4,380	6,137	3,920	2,100	945	500	360	2,835
12	296	482	370	3,591	4,493	7,906	4,162	2,043	930	500	375	1,530
13	296	482	370	1,722	4,607	7,953	5,157	1,872	950	500	415	1,775
14	286	482	370	1,050	4,689	8,351	5,052	1,578	954	500	1,000	1,560
15	286	400	378	934	4,771	8,428	4,556	1,572	950	500	1,510	1,060
16	291	389	400	1,725	4,400	7,620	4,200	1,902	806	470	1,390	950
17	291	374	400	35,825	4,400	6,691	4,092	1,673	806	470	1,200	700
18	340	358	400	66,384	4,400	6,064	3,874	1,600	806	470	860	470
19	361	358	400	79,237	4,400	5,956	4,317	1,388	806	390	700	450
20	350	358	385	40,170	5,010	5,882	5,297	1,357	806	354	674	685
21	340	357	380	18,101	4,703	6,095	4,738	1,370	806	354	780	650
22	340	357	380	14,120	5,481	6,388	4,531	1,385	806	360	530	650
23	335	356	380	13,267	6,796	9,385	4,448	1,326	806	366	490	550
24	321	359	380	6,603	4,480	28,260	4,329	1,074	806	366	465	548
25	296	359	380	3,658	5,240	21,400	4,293	758	540	463	455	520
26	336	359	380	3,797	4,100	14,059	4,357	1,295	540	460	550	500
27	306	359	380	4,323	4,235	11,350	3,878	1,127	540	458	650	475
28	296	359	370	13,192	5,570	9,036	3,738	1,270	540	608	900	455
29	296	339	370	43,429	6,400	7,550	3,706	1,208	540	510	915	432
30	295	339	370	23,648	....	7,018	3,834	1,122	490	574	1,100	390
31	295	....	410	17,546	....	6,554	....	892	....	600	1,200	......

Monthly discharge of Salt River near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	412	286	318	19,600
November	498	289	375	22,300
December	410	339	378	23,200
January	79,200	421	13,000	799,000
February	10,900	2,570	4,880	281,000
March	28,300	4,480	8,350	513,000
April	5,520	3,570	4,310	256,000
May	3,320	758	1,770	109,000
June	993	490	820	48,800
July	610	354	459	28,200
August	1,510	400	692	42,500
September	3,340	390	940	55,900
The year	79,200	286	3,030	2,200,000

NOTE.—This table computed by engineers of the United States Geological Survey from records furnished by the United States Reclamation Service.

WHITE RIVER AT FORT APACHE, ARIZ.

LOCATION.—At highway bridge on Fort Apache military reservation, just below junction of North and East forks, at Fort Apache, Navajo County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 23, 1912, to September 30, 1916.

GAGE.—Vertical staff fastened to downstream end of left abutment of bridge; read by M. Jesús Velásquez. January 27, 1915, datum of gage was raised 4.4 feet.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

Channel and control.—Sand and gravel; fairly permanent at low stages, but likely to shift during floods. Banks high; not subject to overflow except by highest floods.

Extremes of discharge.—1912–1916: River overflowed its banks January 18 and 19, 1916; discharge not determined, but was probably greater than at any other time since the station was established; minimum discharge, 25 second-feet November 3, 4, 1915.

Diversions.—A small quantity of water (amount not known) is diverted for irrigation by the Indians several miles above the station.

Accuracy.—Stage-discharge relation changed during flood of January 17–18. Rating curves used before January 17 fairly well defined from 80 to 600 second-feet; curve used after that date fairly well defined from 90 to 1,400 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fairly accurate, except for extremely low and high stages, for which the rating curve is poorly defined.

Cooperation.—Gage-height record furnished by United States Army.

Discharge measurements of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 17	M. D. Anderson........	1.76	1,400	Sept. 21	Ellsworth and Spiegel..	0.10	177
17	.....do.................	1.76	1,400	21	.....do.................	.10	183

Daily discharge, in second-feet, of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1	90	32	47	105	505	675	1,460	1,070	212	180	152	180
2	76	32	47	105	475	568	1,320	1,020	180	180	152	212
3	76	25	47	90	505	475	1,190	960	196	180	180	196
4	66	25	47	90	448	505	1,070	960	201	180	152	180
5	66	32	47	76	475	535	1,020	908	206	180	166	180
6	66	66	140	76	448	535	960	960	212	180	152	196
7	63	105	140	90	448	535	1,020	1,070	230	180	180	152
8	66	90	122	90	505	568	1,070	1,070	230	180	180	285
9	66	90	105	105	505	675	1,190	1,070	247	173	152	348
10	66	102	105	287	568	908	1,260	1,070	212	166	180	370
11	66	115	90	287	568	1,260	1,460	1,020	....	166	166	370
12	66	128	90	184	568	1,540	1,460	1,070	....	166	180	326
13	60	140	90	260	568	1,610	1,390	1,130	....	166	152	266
14	55	140	76	184	535	1,680	1,260	1,070	....	152	152	230
15	66	122	76	267	568	1,020	1,130	1,020	....	152	166	212
16	66	122	90	1,130	638	1,460	1,260	855	....	180	180	212
17	55	122	90	....	600	1,390	1,320	675	....	180	180	247
18	55	122	90	....	718	1,460	1,610	675	....	180	152	247
19	55	105	76	3,300	718	1,460	1,610	535	247	180	166	212
20	55	105	76	2,800	718	1,610	1,540	535	247	180	212	180
21	55	105	76	2,180	808	1,190	1,540	....	266	166	180	180
22	55	90	76	1,130	760	2,000	1,610	....	266	180	180	180
23	55	105	76	960	808	2,620	1,540	....	285	180	152	166
24	47	76	90	370	808	2,000	1,540	....	285	152	180	166
25	47	66	105	475	808	1,540	1,390	....	266	152	180	166
26	47	66	105	420	855	1 540	1,320	....	247	180	152	152
27	47	55	90	420	855	1,540	1,260	....	285	180	152	152
28	47	55	90	3,830	908	1,460	1,260	....	306	180	180	140
29	47	55	76	1,840	908	1,610	1,130	180	348	152	247	128
30	47	55	76	505	....	1,540	1,070	212	370	166	247	116
31	39	....	76	420	....	1,610	....	180	....	180	212	....

Note.—Gage not read Oct. 13, Nov. 10–12, and July 9; discharge interpolated. Gage not read: discharge estimated from weather records and by comparison with records for other stations as follows: Jan. 17 and 18, 3,800 second-feet; May 21–28, 350 second-feet; June 11–18, 230 second-feet.

Monthly discharge of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	90	39	59.2	3,640
November	140	25	84.9	5,050
December	140	47	84.7	5,210
January		76	[a] 958	58,900
February	908	448	641	36,900
March	2,620	475	1,260	77,500
April	1,610	960	1,310	78,000
May	1,130	180	[a] 712	43,800
June	370	180	[a] 246	14,600
July	180	152	172	10,600
August	247	152	175	10,800
September	370	116	211	12,600
The year		25	492	358,000

[a] Partly estimated; see footnote to table of daily discharge.

EAST FORK OF WHITE RIVER AT FORT APACHE, ARIZ.

Location.—On Fort Apache Military Reserve at Fort Apache, Navajo County, about half a mile above junction with North Fork of White River.

Drainage area.—Not measured.

Records available.—November 8, 1912, to September 30, 1916.

Gage.—Vertical staff fastened to ash tree on left bank opposite officers' quarters. January 27, 1915, a new staff gage was installed and the datum raised 5 feet.

Discharge measurements.—Made by wading near gage.

Channel and control.—Boulders and gravel; slightly shifting.

Extremes of discharge.—Maximum stage and discharge during year not determined minimum discharge 15 second-feet November 3–5.

1912–1916: Maximum stage and discharge not determined; minimum discharge 5 second-feet February 14–16, 1914.

Accuracy.—Stage-discharge relation changed during high water on January 17–18. Rating curve used before January 17 fairly well defined at all stages. Curve used after that date fairly well defined between 40 and 250 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fairly accurate except for high stages, for which rating curve is poorly defined.

Cooperation.—Gage-height record furnished by United States Army.

Discharge measurements of East Fork of White River at Fort Apache, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 17	M. D. Anderson	1.40	216	Sept. 21	Ellsworth and Spiegel	.25	41.2
17	do	1.40	232	21	do	.25	42.2

Daily discharge, in second-feet, of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	22	16	18	27	289	212	333	249	38	38	38	52
2	22	16	18	27	262	190	318	236	42	38	30	47
3	22	15	18	24	249	180	289	236	38	38	34	42
4	20	15	18	24	275	160	236	224	35	38	30	38
5	20	15	24	22	262	170	212	236	32	38	38	38
6	20	24	27	22	236	180	201	249	30	38	34	47
7	20	24	30	24	236	180	212	224	34	38	42	47
8	18	30	30	24	224	190	224	212	34	38	38	57
9	18	30	27	27	212	224	224	201	38	38	30	57
10	18	33	27	56	224	333	212	224	34	38	38	68
11	18	36	24	61	212	382	224	212	....	38	38	68
12	18	39	24	42	224	398	249	212	....	30	38	57
13	18	42	22	51	236	450	236	224	....	34	38	57
14	20	42	22	42	224	262	224	224	....	30	34	47
15	20	38	22	67	212	333	249	212	....	30	38	47
16	20	38	24	73	201	349	249	180	....	38	57	38
17	18	38	24	....	190	318	236	160	....	42	62	47
18	18	38	24	....	190	333	262	160	....	38	47	47
19	18	34	22	704	180	333	262	142	47	38	52	38
20	18	34	22	581	190	349	275	125	47	38	42	38
21	18	34	22	398	224	432	262	....	47	38	34	42
22	18	30	22	365	224	432	249	....	42	38	38	38
23	18	34	22	303	236	562	275	....	34	30	38	34
24	20	27	24	236	249	432	275	....	42	30	47	38
25	16	24	27	160	249	349	249	....	47	30	47	38
26	16	22	27	125	236	333	249	....	52	38	47	42
27	16	20	24	102	236	333	262	....	57	38	47	34
28	16	18	24	853	224	303	275	....	57	38	57	30
29	16	18	24	467	224	333	262	30	68	38	47	30
30	16	18	22	382	....	333	262	34	68	38	38	30
31	16	....	22	224	....	318	....	34	....	38	47	....

NOTE.—Gage not read Nov. 10–12, June 4, 5 and 25; discharge interpolated. Discharge estimated because of lack of gage readings, from weather record and study of record of flow at other stations as follows: Jan. 17 and 18, 900 second-feet; May 21–28, 80 second-feet; June 11–18, 40 second-feet. See "Accuracy" in station description.

Monthly discharge of East Fork of White River at Fort Apache, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	22	16	18.5	1,140
November	42	15	28.1	1,670
December	30	18	23.4	1,440
January	....	22	236	14,500
February	289	180	229	13,200
March	562	160	312	19,200
April	333	201	252	15,000
May	249	....	157	9,650
June	68	....	42.8	2,550
July	42	30	36.4	2,240
August	62	30	41.5	2,550
September	68	30	44.4	2,640
The year	....	15	118	85,800

TONTO CREEK NEAR ROOSEVELT, ARIZ.

Location.—In sec. 14, T. 6 N., R. 10 E., 6 miles above upper end of Roosevelt reservoir and 15 miles northwest of town of Roosevelt, in Gila County.

Drainage area.—1,004 square miles (measured by United States Reclamation Service).

Records available.—October 1, 1913, to September 30, 1916.

Gage.—Vertical staff on right bank. Position of gage is changed from time to time owing to shifting control.

Discharge measurements.—Made by wading at low stages and by slope method at high stages. Measurements are made frequently by engineer of United States Reclamation Service stationed at Roosevelt dam.

Channel and control.—Boulders and gravel; shifting at high stages. One channel at all stages.

Extremes of discharge.—Maximum mean daily discharge during year, 15,847 second-feet January 19; minimum discharge, 5 second-feet November 2–7, No, vember 24 to December 6, and December 10–14.

1913–1916: Maximum mean daily discharge January 19, 1916; minimum, 2 second-feet August 15–19, 1914.

Diversions.—No diversions in vicinity of station; entire flow is discharged into Roosevelt reservoir.

Accuracy.—Records reported as fair by U. S. Reclamation Service.

Cooperation.—Daily-discharge record furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	6	5	750	600	150	150	100	80	20	15	70
2	8	5	5	150	400	150	150	100	80	10	100	50
3	8	5	5	75	300	150	150	94	80	10	54	45
4	8	5	5	40	240	100	120	90	80	10	50	45
5	8	5	5	25	240	100	120	90	80	10	20	43
6	8	5	5	30	200	100	120	90	80	10	20	40
7	8	5	8	38	200	80	120	90	50	10	20	17
8	8	8	8	38	200	80	100	90	50	10	20	17
9	8	8	8	38	200	80	100	90	50	10	10	565
10	8	8	5	38	300	80	100	90	50	10	10	480
11	8	8	5	100	300	100	100	90	50	10	10	395
12	8	8	5	112	300	100	100	90	50	10	10	310
13	8	8	5	112	300	100	100	90	50	10	200	225
14	8	8	5	50	300	200	100	90	40	10	200	140
15	8	8	10	50	300	200	100	90	30	10	200	60
16	8	8	10	1,000	200	200	100	90	20	10	275	50
17	8	8	10	7,165	200	180	100	88	20	10	200	50
18	6	8	10	13,276	200	180	100	82	20	10	200	50
19	6	8	10	15,547	200	180	100	82	20	10	200	50
20	6	8	10	8,036	200	180	100	80	20	10	180	50
21	6	8	10	3,620	200	180	100	80	20	10	150	50
22	6	8	10	2,824	200	180	100	80	20	10	130	50
23	6	8	10	2,653	250	200	100	80	20	12	130	40
24	6	5	10	1,320	200	400	100	80	20	12	110	40
25	6	5	10	732	200	400	100	80	20	12	195	40
26	6	5	10	759	150	400	100	80	20	12	150	30
27	6	5	10	865	150	300	100	80	20	12	100	30
28	6	5	10	2,638	200	300	100	80	20	12	100	20
29	6	5	10	8,686	200	300	100	80	20	60	70	18
30	6	5	10	4,749	......	300	100	80	20	31	40	15
31	6	......	800	3,509	......	250	......	80	......	15	80	......

Monthly discharge of Tonto Creek near Roosevelt, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8	6	7.1	437
November	8	5	6.6	393
December	800	5	33.5	2,060
January	15,800	25	2,560	157,000
February	600	150	246	14,200
March	400	80	190	11,700
April	150	100	108	6,430
May	100	80	86.3	5,310
June	80	20	40.0	2,380
July	60	10	13.2	812
August	275	10	105	6,460
September	565	15	103	6,130
The year	15,800	5	294	213,000

NOTE.—This table computed by engineers of the United States Geological Survey from records furnished by the United States Reclamation Service.

VERDE RIVER NEAR CLARKDALE, ARIZ.

LOCATION.—In T. 17 N., R. 3 E., about 4 miles below the mouth of Sycamore Creek and about 5 miles above Clarkdale, Yavapai County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18, 1915, to September 30, 1916.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from cable at gage, or by wading near gage.

CHANNEL AND CONTROL.—Gravel and boulders; fairly permanent at low stages liable to shift at high stages.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 11.93 feet at 11 p. m., January 18 (discharge, determined from extension of rating curve, 6,860 second-feet); minimum stage, from water-stage recorder 2.12 feet at 9 p. m. June 12 (discharge, 73 second-feet).

1915–1916: maximum stage recorded January 18, 1916; minimum stage 2.10 feet on August 4, 11, and 12, 1915 (discharge 70 second-feet).

DIVERSION.—Water is diverted above and below station to irrigate a few small ranches amount not known.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve fairly well defined below 1,000 second-feet. Operation of water-stage recorder satisfactory throughout the year. Daily discharge ascertained by applying to the rating table daily gage height determined by inspecting gage-height graph. Records fair except for extremely high stages for which the rating curve is poorly defined.

COOPERATION.—Station established and maintained in cooperation with United Verde Copper Co.

Discharge measurements of Verde River near Clarkdale, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 15	Anderson and Gittings	4.95	850
Aug. 16	Ellsworth and Anderson	2.50	132

Daily discharge, in second-feet, of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	78	79	80	85	575	435	147	78	78	78	100	78
2	78	79	80	85	536	378	102	78	78	78	188	78
3	78	79	80	85	542	422	88	78	78	78	127	78
4	78	79	84	85	512	584	84	78	76	78	88	78
5	79	79	84	94	455	1,410	84	78	78	78	93	78
6	80	85	82	92	400	1,960	85	78	78	78	147	78
7	80	90	80	92	412	2,210	84	78	76	78	97	78
8	80	82	80	90	590	2,270	85	78	76	78	90	134
9	79	82	80	90	750	1,570	84	78	78	82	87	115
10	79	84	80	90	776	1,280	82	78	78	93	79	115
11	79	82	80	94	848	1,250	82	78	76	138	78	88
12	80	80	80	90	920	1,350	80	78	76	78	80	82
13	79	80	80	90	902	1,290	79	78	76	78	165	78
14	79	80	80	94	880	1,160	78	78	78	119	345	78
15	80	80	92	95	880	1,250	76	78	78	85	395	78
16	80	80	87	102	952	1,180	76	78	78	79	147	80
17	79	80	84	395	1,180	1,050	76	79	78	78	93	88
18	79	80	82	5,170	1,220	1,040	78	80	78	78	80	78
19	79	80	82	1,450	1,160	1,080	78	82	78	78	78	78
20	79	80	82	627	1,190	1,180	78	80	78	78	78	78
21	79	82	84	554	1,350	1,890	78	80	78	87	78	78
22	79	82	82	390	1,310	1,320	78	78	78	88	78	78
23	79	82	82	252	1,280	1,430	78	78	78	79	78	78
24	79	82	82	252	880	1,320	78	78	78	79	78	78
25	79	82	82	252	666	984	78	78	78	156	78	78
26	78	82	82	252	575	756	78	78	78	230	78	78
27	78	82	82	250	506	506	78	78	78	215	149	78
28	78	92	82	3,740	479	375	78	78	78	112	581	78
29	78	82	82	1,530	461	302	78	78	78	362	220	78
30	78	82	95	820	......	245	78	78	78	408	108	78
31	78	......	94	545	......	215	......	78	......	112	79	......

Monthly discharge of Verde River near Clarkdale, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	80	78	78.9	4,850
November	90	79	81.3	4,840
December	95	80	82.8	5,090
January	5,170	85	578	35,500
February	1,350	400	800	46,000
March	2,270	215	1,090	67,000
April	147	76	82.9	4,930
May	82	78	78.4	4,820
June	78	76	77.6	4,620
July	408	78	117	7,190
August	581	78	137	8,420
September	134	78	83.2	4,950
The year	5,170	76	273	198,090

VERDE RIVER AT CAMP VERDE, ARIZ.

Location.—In sec. 30, T. 14 N., R. 5 E., at steel highway bridge just above town of Camp Verde, Yavapai County, and above mouth of Beaver Creek.

Drainage area.—Not measured.

Records available.—December 5, 1912, to September 30, 1916.

Gage.—Chain gage on downstream side of bridge; installed November 12, 1915, at datum 1.80 feet above that of original gage, which was a vertical staff painted on east pier of bridge. Gage read by Nicholas A. Vyne.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Channel straight; clay and sand bottom. Banks fairly high; not likely to be overflowed. Control shifts, especially during high stages.

Extremes of discharge.—Maximum stage during year, 17.0 feet on night of January 18 (discharge not determined); minimum discharge, 40 second-feet October 5–7.

1912–1916: Maximum stage January 18, 1916; minimum discharge, 31 second-feet June 28, 29, 1914.

Diversions.—Much of the low-stage flow is diverted for irrigation at various points up the valley.

Accuracy.—Stage-discharge relation changed considerably during high water in January and slightly at various times during low stages. Rating curves fairly well defined below 3,000 second-feet except for extremely low stages, for which discharge measurements are too few to indicate the date of slight shifts in control. Gage read once daily to half-tenths; oftener during floods. Daily discharge ascertained by applying gage height to rating table. Records fair except for extremely low and high stages, for which the rating curve is poorly defined.

Discharge measurements of Verde River at Camp Verde, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	M. D. Anderson........	3.50	199	Aug. 13	Ellsworth and Anderson	1.71	448
Feb. 17	.....do..................	3.80	2,430	14	.....do..................	2.37	938
Apr. 22	.....do..................	.85	114	15	.....do..................	2.85	1,400
Aug. 13	Ellsworth and Anderson	.90	94	28	M. D. Anderson	.88	126

Daily discharge, in second-feet, of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	70	130	162	220	800	2,080	685	100	105	110	220	260
2	60	130	162	262	760	1,970	615	100	105	110	220	220
3	50	130	162	240	720	1,750	350	100	105	110	240	200
4	50	130	180	240	650	1,580	300	100	105	110	260	165
5	40	130	199	240	550	2,620	280	100	105	110	240	140
6	40	162	180	220	490	3,120	240	100	110	110	240	130
7	40	162	180	220	400	2,620	240	100	110	110	240	130
8	50	199	180	240	650	1,970	220	110	105	110	240	130
9	50	180	180	262	1,480	2,080	180	110	105	110	200	400
10	50	180	180	240	1,280	4,120	130	100	105	110	180	580
11	50	199	180	240	1,530	5,010	180	100	105	105	150	400
12	50	180	180	240	1,640	4,260	165	100	105	105	140	260
13	50	162	180	220	1,640	3,840	165	100	105	105	430	180
14	50	162	180	220	1,860	3,120	165	100	110	110	260	165
15	50	162	199	262	1,700	2,020	150	100	105	150	1,280	150
16	374	162	199	398	1,750	1,860	140	100	105	140	800	165
17	327	162	199	....	1,750	1,640	130	100	105	130	260	200
18	305	162	199	....	2,500	1,280	122	105	110	122	220	180
19	240	162	199	....	2,500	1,180	122	105	110	115	180	180
20	180	162	199	....	2,320	1,140	122	110	110	110	180	165
21	180	162	199	2,380	2,580	1,060	115	110	110	108	150	150
22	180	162	180	1,970	2,920	1,970	110	115	110	105	150	165
23	180	162	180	880	1,970	3,120	110	115	105	105	140	180
24	180	162	180	615	1,580	3,960	105	115	105	122	140	150
25	162	162	180	580	1,700	2,920	105	110	105	122	140	150
26	130	162	180	1,140	2,560	2,620	105	110	110	150	130	140
27	130	162	180	1,140	4,120	2,500	110	110	110	220	130	140
28	130	162	162	....	2,800	2,320	100	110	115	300	130	130
29	130	162	162	....	2,500	1,970	100	110	115	280	350	130
30	130	162	162	3,060	....	1,580	100	105	115	260	400	130
31	130	....	199	1,230	....	1,050	....	105	....	220	300	....

Note.—Discharge Oct. 1 and 2 estimated, July 21 interpolated; gage not read. Discharge estimated, because of backwater from Beaver Creek, by comparison with records for other stations on Verde River as follows: Jan. 17–20, 12,000 second-feet; Jan. 28 and 29, 15,000 second-feet.

Monthly discharge of Verde River at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	374	40	124	7,620
November	199	130	161	9,580
December	199	162	182	11,200
January	....	[a]220	3,060	188,000
February	4,120	400	1,710	98,400
March	5,010	1,050	2,400	148,000
April	685	100	194	11,500
May	115	100	105	6,460
June	115	106	108	6,430
July	300	105	138	8,480
August	1,280	130	270	16,600
September	580	130	196	11,700
The year	....	40	724	524,000

[a] Partly estimated. See footnote to daily-discharge table

VERDE RIVER AT CHILDS, NEAR CAMP VERDE, ARIZ.

Location.—Just below power plant of Arizona Power Co. at Childs, 3 miles above mouth of Fossil Creek and about 18 miles southeast of Camp Verde, Yavapai County.

Drainage area.—Not measured.

Records available.—February 25, 1911, to September 30, 1916.

Gage.—Inclined staff in three sections on left bank about 300 feet below power plant of Arizona Power Co. Read to half-tenths twice daily by engineer of power plant.

Discharge measurements.—Made by wading or from a cable a mile above gage.

Channel and control.—Boulders and bedrock; apparently fairly permanent.

Extremes of stage.—Maximum stage recorded during year, 23 feet at 7.25 a. m. January 19; minimum stage, 4 feet at 6.55 a. m. June 21.

1911–1916: Maximum stage January 19, 1916; minimum stage, 3.2 feet April 27, 28, 1911.

Diversions.—Water is diverted above station for irrigation. See Verde River at Camp Verde, page 179.

Regulation.—A fairly constant flow of about 48 second-feet, diverted from Fossil Creek for power development, is discharged into the river above the gage.

Cooperation.—Gage-height record furnished by United States Reclamation Service.

Permanence of stage-discharge relation not known, as no discharge measurements have been made at this station since October 18, 1913. Daily discharge not determined.

Daily gage height, in feet, of Verde River at Childs, near Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.45	4.75	4.9	5.3	7.7	7.7	6.0	4.55	4.55	4.55	5.25	5.3
2	4.45	4.8	4.85	5.0	7.2	7.2	5.9	4.6	4.6	4.5	5.2	5.3
3	4.45	4.7	4.9	....	6.85	7.05	5.9	4.65	4.65	4.55	5.2	5.2
4	4.45	4.7	4.9	....	6.7	7.2	5.8	4.6	4.7	4.5	5.15	5.1
5	4.5	4.8	5.0	4.95	6.55	7.9	5.7	4.6	4.65	4.6	5.0	5.0
6	4.55	4.85	5.1	5.15	6.5	10.9	5.65	4.65	4.7	4.6	5.1	5.0
7	4.55	4.95	4.95	5.1	6.6	8.6	5.6	4.7	4.7	4.5	5.0	4.9
8	4.6	4.95	4.9	5.15	7.0	7.95	5.5	4.6	4.65	4.55	4.95	5.05
9	4.75	4.9	4.9	5.4	7.75	8.3	5.4	4.55	4.6	4.65	4.9	6.15
10	4.7	5.0	4.9	5.8	7.9	11.25	5.3	4.5	4.65	4.7	5.0	7.25
11	4.7	5.0	4.9	5.75	8.2	11.25	5.35	4.5	4.6	4.65	4.9	6.15
12	4.65	5.0	4.9	5.4	8.2	9.45	5.3	4.55	4.6	4.7	4.9	5.6
13	4.6	4.95	4.95	5.2	8.6	9.05	5.15	4.6	4.55	4.7	5.45	5.35
14	4.65	4.85	4.95	5.1	8.45	8.55	5.2	4.65	4.55	4.75	5.55	5.3
15	4.6	4.9	5.05	5.25	8.45	7.9	5.15	4.75	4.5	4.7	7.5	5.2
16	5.05	4.85	5.0	5.9	8.4	7.3	5.15	4.7	4.5	4.75	6.0	5.2
17	4.8	4.85	5.05	10.1	9.1	7.3	5.1	4.7	4.55	4.8	5.6	5.2
18	4.8	4.85	5.0	19.8	9.15	7.15	5.0	4.65	4.5	4.8	5.25	5.1
19	4.8	4.9	4.95	21.3	8.95	7.05	5.05	4.7	4.5	4.7	5.2	5.1
20	4.75	4.9	4.95	14.85	8.9	7.25	5.0	4.7	4.5	4.7	5.1	5.1
21	4.7	4.8	4.9	9.5	9.05	10.15	4.9	4.75	4.3	4.65	5.1	5.1
22	4.7	4.85	4.9	8.25	9.7	11.3	4.85	4.8	4.55	4.65	5.0	5.1
23	4.7	4.95	4.9	7.7	8.35	11.95	4.85	4.8	4.55	4.7	5.05	5.05
24	4.75	4.85	5.0	7.6	7.75	11.2	4.8	4.65	4.6	4.6	5.1	5.05
25	4.8	4.8	4.95	7.6	7.65	8.9	4.75	4.7	4.55	4.6	5.1	5.05
26	4.75	4.85	4.9	7.9	8.2	9.4	4.75	4.7	4.55	4.85	5.25	5.05
27	4.75	4.9	4.9	8.15	9.8	8.95	4.7	4.65	4.6	5.85	4.95	5.05
28	4.7	4.85	4.9	19.35	11.0	7.45	4.7	4.7	4.6	5.55	5.0	5.0
29	4.7	4.8	4.9	16.0	8.85	7.0	4.75	4.6	4.55	5.25	5.45	5.0
30	4.7	4.85	5.1	12.05	....	6.7	4.55	4.6	4.55	5.5	5.85	5.0
31	4.7	....	5.25	8.8	....	6.25	....	4.65	....	5.65	5.4	....

NOTE.—No gage-height record Jan. 3 and 4.

VERDE RIVER NEAR McDOWELL, ARIZ.

LOCATION.—At dam site on Salt River Indian Reservation, three-fourths mile above junction with Salt River and about 5½ miles below McDowell, Maricopa County.

DRAINAGE AREA.—6,000 square miles (measured by United States Reclamation Service).

RECORDS AVAILABLE.—August 14 to September 30, 1889; April 20, 1897, to November 11, 1899; January 1, 1901, to April 19, 1902; July 23–26, 1902; January 1, 1903, to September 30, 1916.

GAGE.—Painted directly on granite rocks on right bank.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading. Since November, 1913, measurements have been made regularly three or four times a week by a man stationed at gage.

CHANNEL AND CONTROL.—Sand; shifting.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 53,350 second-feet January 19; minimum discharge, 115 second-feet July 9 and 10.

1897–1915: Maximum mean daily gage height, 17.0 feet November 27, 1905 (discharge, 61,640 second-feet); minimum discharge, 32 second-feet July 19 and 20, 1904.

DIVERSIONS.—See Verde River at Camp Verde, page 179. A small quantity of water is also diverted 5 miles above station for use on Indian Reservation.

ACCURACY.—Records reported as good by U. S. Reclamation Service.

COOPERATION.—Daily discharge record furnished by United States Reclamation Service.

Daily discharge, in second-feet, of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	158	195	265	3,050	1,800	3,000	1,700	300	170	129	580	460
2	160	195	262	1,562	1,300	1,000	1,700	260	186	129	660	423
3	160	195	255	825	980	900	1,650	260	214	129	500	405
4	157	185	252	700	1,200	1,000	1,180	260	214	129	410	372
5	152	185	258	525	890	1,000	960	260	210	129	340	345
6	148	185	275	525	800	1,150	900	255	179	129	362	302
7	148	235	312	675	800	1,900	820	255	172	125	300	280
8	146	225	300	850	820	1,900	800	255	172	120	290	252
9	135	225	288	800	820	1,400	720	237	202	115	295	1,048
10	135	255	270	900	820	1,650	700	237	190	115	275	20,700
11	132	285	288	960	750	2,400	610	225	190	150	250	4,680
12	158	285	288	1,175	800	3,000	590	240	190	170	270	1,900
13	162	350	275	1,100	800	2,800	550	224	185	170	255	968
14	168	325	262	875	800	2,400	580	224	160	200	244	655
15	160	305	262	750	800	2,400	620	220	145	190	1,060	410
16	160	275	275	1,000	760	2,000	570	220	145	160	1,710	540
17	158	262	425	12,000	700	1,800	570	220	145	160	1,950	475
18	160	255	418	28,000	800	1,700	570	230	145	160	1,300	445
19	160	250	412	53,350	900	1,400	570	230	140	170	655	450
20	220	245	400	44,865	900	1,850	600	208	130	160	496	415
21	240	238	365	2,912	900	1,800	540	218	130	150	150	405
22	232	238	330	2,062	1,000	5,500	430	220	130	160	340	395
23	230	252	288	1,800	2,200	10,200	450	262	125	160	296	385
24	225	242	288	1,740	1,300	18,500	450	227	121	160	280	380
25	225	235	282	1,450	1,000	12,000	420	227	130	150	358	372
26	210	252	282	1,100	800	4,500	365	214	132	150	495	328
27	200	275	282	1,500	900	2,450	365	205	129	154	360	320
28	200	275	275	18,000	900	3,000	310	205	129	330	310	310
29	200	262	288	22,600	5,000	2,050	300	200	129	660	272	305
30	200	270	302	9,800	......	2,000	300	210	129	738	340	250
31	200	......	3,150	2,250	......	1,900	......	170	......	480	290	......

Monthly discharge of Verde River near McDowell, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	240	132	177	10,900
November	350	185	248	14,800
December	3,150	252	393	24,200
January	53,350	525	7,090	436,000
February	5,000	800	1,110	63,800
March	18,500	900	3,210	197,000
April	1,700	300	696	41,400
May	300	170	232	14,300
June	214	121	159	9,460
July	738	115	201	12,400
August	1,950	150	506	31,100
September	20,700	250	1,300	77,400
The year	53,350	115	1,290	933,000

NOTE.—Monthly and yearly discharge computed by engineers of United States Geological Survey from daily-discharge records furnished by United States Reclamation Service.

BEAVER CREEK AT CAMP VERDE, ARIZ.

Location.—In sec. 30, T. 14 N., R. 5 E., one-fourth mile above junction with Verde River and about a mile northeast of Camp Verde, Yavapai County.

Drainage area.—Not measured.

Records available.—December 1, 1912, to September 30, 1916.

Gage.—Inclined and vertical staff on right bank installed August 14, 1916, at same datum and at practically same site as original gage, which was washed out January 21, 1916. From January 22 to August 13, 1916, a temporary gage at a datum 1.46 feet above the original gage was used. All readings on temporary gage reduced to datum of original gage. Observer, Nicholas A. Vyne.

Discharge measurements.—Made by wading near gage.

Channel and control.—Sand, clay, and solid rock; somewhat shifting.

Extremes of discharge.—Maximum mean daily discharge during year, about 4,950 second-feet January 17; maximum stage recorded during year, 13.0 feet during night of January 18 (caused by backwater from Verde River). Minimum discharge during year, 7 second-feet July 8–10 and September 2–7.

1912–1916: Maximum discharge not determined. Minimum discharge, 1.5 second-feet April 26–30, 1913.

Diversions.—Water is diverted for irrigation at several points above the station. Quantity unknown. A small amount of water is discharged into the creek above the gage at times by an irrigation ditch which diverts from Verde River above the mouth of Beaver Creek.

Accuracy.—Stage-discharge relation changed during high water in January; fairly permanent for remainder of year. Rating curve fairly well defined below 1,000 second-feet and poorly defined above. Gage read to half tenths once daily; oftener during high water. Daily discharge ascertained by applying daily gage height to rating table except when stage-discharge relation was affected by backwater from Verde River (see footnote to daily-discharge table). Records fair, except those for high stages.

Discharge measurements of Beaver Creek at Camp Verde, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 12	M. D. Anderson	4.05	11.1	Aug. 14	Ellsworth and Anderson	4.32	29.0
Feb. 2	.....do	5.66	[a] 652	15	.....do	4.83	151
Apr. 22	.....do	4.21	15.3	28	M. D. Anderson	4.07	8.1
Aug. 13	Ellsworth and Anderson	4.16	8.8				

[a] Surface velocity determined with floats and coefficient of 0.80 used to reduce to mean velocity.

Daily discharge, in second-feet, of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	10	14	17	1,200	159	159	8	8	8	122	8
2	10	10	14	23	1,000	138	138	8	13	8	78	7
3	10	10	14	29	860	105	105	8	13	8	46	7
4	10	10	17	17	860	122	92	8	8	8	55	7
5	10	10	17	23	815	650	78	8	8	13	46	7
6	10	10	17	23	1,260	505	78	8	8	13	37	7
7	10	23	14	17	1,150	435	92	8	8	13	30	7
8	10	17	14	17	1,100	310	78	8	8	7	37	10
9	14	14	14	29	1,150	505	55	8	8	7	37	105
10	14	17	14	78	1,050	1,000	46	8	8	7	37	55
11	14	14	14	78	1,100	1,320	37	8	8	8	13	55
12	14	14	14	55	1,440	1,260	30	10	8	8	13	55
13	14	14	14	46	1,000	1,150	18	10	8	8	13	37
14	14	14	14	23	860	1,000	37	10	8	10	23	13
15	14	14	17	37	730	435	30	10	8	13	310	13
16	14	14	17	78	905	505	30	13	8	13	78	13
17	29	14	17	4,950	1,380	400	23	10	8	10	30	13
18	23	14	17	....	815	310	13	8	8	10	13	10
19	23	14	14	....	770	255	13	8	8	10	13	10
20	17	14	14	860	730	205	13	8	8	10	10	10
21	17	14	14	1,440	815	1,620	10	8	8	10	8	10
22	17	14	14	1,320	1,440	3,630	10	8	13	10	8	10
23	14	14	14	1,150	650	815	10	13	13	10	8	10
24	10	14	14	950	950	575	8	13	10	18	8	8
25	10	10	14	860	470	815	8	8	10	18	8	8
26	14	10	14	1,000	610	905	8	8	8	23	8	8
27	14	10	14	730	540	770	8	8	8	66	8	8
28	10	10	14	....	1,050	770	8	8	8	55	8	8
29	10	10	14	....	340	690	8	8	8	46	8	8
30	10	10	17	2,080	....	505	8	8	8	46	8	8
31	10	....	23	1,440	....	205	....	8	....	37	8	....

NOTE.—Discharge estimated because of backwater from Verde River, as follows: Jan. 18–19, 2,000 second-feet; Jan. 28–29, 1,500 second-feet. Discharge, Jan. 17 and 30 and Feb. 21 and 22, estimated from extension of rating curve, and is roughly approximate.

Monthly discharge of Beaver Creek at Camp Verde, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	29	10	13.5	830
November	23	10	12.9	768
December	23	14	15.1	928
January	4,950	17	786	48,300
February	1,440	340	932	53,600
March	3,630	105	712	43,800
April	159	8	41.7	2,480
May	13	8	88.1	542
June	13	8	8.80	524
July	66	7	17.1	1,050
August	310	8	36.4	2,240
September	105	7	17.8	1,060
The year	4,950	7	215	156,000

AGUA FRIA RIVER NEAR GLENDALE, ARIZ.

LOCATION.—In sec. 28, T. 6 N., R. 1 E., at old diversion dam of the Beardsley irrigation project, at Camp Dyer, 4 miles below mouth of Castle Creek and 22 miles northwest of Glendale, Maricopa County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 10, 1910, to September 30, 1916.

Gage.—Stevens water-stage recorder on right bank installed October 2, 1913; destroyed by flood January 27, 1916, and replaced March 21, 1916; during the interval staff gage readings were made by R. Jones. From August 28, 1913, to October 2, 1913, a Richard Frères water-stage recorder was used. Prior to August 28, 1913, gages were vertical staffs, either painted on or attached to the masonry diversion dam, with a datum 20 feet lower than that used for the water-stage recorders.

Discharge measurements.—Made by wading near gage or from cable about one-third of a mile below gage.

Channel and control.—Bed of channel above and below the dam composed of shifting sand and gravel. Principal control is formed by the remains of the old diversion dam which failed during the flood of 1895, when a portion of masonry near each end was washed out. At low and medium stages the entire stream flows through the larger opening which is near the right bank. This control shifted considerably as the crevices in the dam were filled in with sand, which washed out during high stages. On October 18, 1914, an artificial control was completed across the right opening or gap in the dam, but was partly destroyed by flood January 29, 1915. It was repaired October 28, 1915, but was again partly destroyed during the floods of January, 1916.

Extremes of discharge.—Maximum stage during year, from flood marks, 30 feet about 7 p. m., January 27 (discharge, determined from extension of rating curve, 105,000 second-feet); minimum discharge, 2 second-feet October 19–27 and November 20.

Diversions.—Water (amount not known) is diverted above the gage for irrigating two or three small ranches.

Accuracy.—Stage-discharge relation not permanent (see "Channel and control." The 38 measurements made during the year, together with two high-stage measurements made during April, 1917, were used to construct rating curves applicable as follows :November 7–23, poorly defined; December 30 to March 22, fairly well defined below 13,000 second–feet; March 23 to July 10, well defined below 300 second-feet and fairly well defined for all stages; September 3–30, fairly well defined below 40 second-feet. Shifting-control method used to determine discharge for other periods. Operation of the water-stage recorder not satisfactory during much of year (see footnote to daily-discharge table). Records fair from April 1 to July 12, August 8 to September 3, and September 14–30; poor for rest of year.

Discharge measurements of Agua Fria River near Glendale, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	Jacob and Horton	2.06	2.7	Feb. 4	C. C. Jacob	4.60	587
13	Anderson and Jackson	2.07	3.9	12	.....do	4.00	438
13	.....do	2.08	3.6	Mar. 3	M. D. Anderson	3.55	301
22	Loren Guthrie	2.10	2.1	3	.....do	3.55	328
23	.....do	2.10	2.1	21	.....do	2.30	142
Nov. 1	Anderson and Guthrie	3.25	3.4	Apr. 1	.....do	4.15	279
8	J. B. Spiegel	3.64	41.4	1	.....do	4.15	288
8	.....do	3.65	42.6	29	.....do	2.74	58
8	M. D. Anderson	3.65	42.2	29	.....do	2.74	57
8	.....do	3.65	42.0	May 22	.....do	2.21	26.0
23	Anderson and Guthrie	3.30	3.4	22	.....do	2.21	28.2
23	.....do	3.30	3.2	June 28	.....do	1.62	4.4
Dec. 29	C. C. Jacob	3.45	7.4	July 12	Ellsworth and Anderson	2.48	27.3
Jan. 20	M. D. Anderson	7.68	2,980	Aug. 8	M. D. Anderson	1.45	24.3
20	.....do	7.45	2,320	Sept. 3	C. E. Ellsworth	1.41	13.3
20	.....do	7.45	2,250	3	.....do	1.40	11.7
21	.....do	6.30	1,530	14	.....do	2.00	32.6
21	.....do	6.35	1,360	14	.....do	2.00	33.6
21	.....do	6.20	1,200				
21	.....do	6.20	1,220				

Daily discharge, in second-feet, of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	3	12	......	1,080	......	270	48	13	4	......	48
2	3	3	12	......	885	......	258	48	13	4	......	27
3	3	3	14	......	689	311	246	48	12	4	......	15
4	3	3	17	......	604	......	234	45	10	4	......	......
5	3	3	28	......	......	......	223	43	10	4	......	......
6	3	3	29	......	......	......	212	40	10	4	......	......
7	3	800	36	......	......	......	192	37	10	3	......	......
8	3	213	29	......	......	......	183	34	9	4	24	......
9	4	22	29	......	......	......	174	32	9	4	15	......
10	4	12	29	......	......	......	165	30	8	15	14	......
11	4	6	29	......	......	......	156	28	7	99	13	......
12	4	5	29	......	423	......	148	28	7	44	145	......
13	4	5	29	......	......	......	156	26	7	......	28	......
14	4	5	29	......	......	......	202	24	7	......	31	33
15	4	5	65	......	......	......	202	23	6	......	212	26
16	3	4	75	......	......	......	174	22	6	......	170	22
17	3	4	45	......	......	......	148	22	6	......	51	19
18	3	4	30	......	......	......	140	23	6	......	26	19
19	2	3	24	29,500	......	......	126	22	5	......	16	18
20	2	2	24	2,710	......	......	112	23	5	......	14	17
21	2	3	18	1,380	......	152	106	24	5	......	13	18
22	2	4	20	930	......	......	98	24	5	......	13	17
23	2	4	18	802	......	......	95	22	5	......	27	16
24	2	6	18	725	......	......	81	20	4	......	177	15
25	2	6	14	1,080	......	......	73	18	4	......	36	13
26	2	6	12	......	......	......	67	17	4	......	35	13
27	2	8	12	......	......	......	63	16	4	......	145	13
28	3	8	12	......	......	......	57	16	4	......	74	13
29	3	10	8	......	......	......	55	15	4	......	79	13
30	3	12	1,660	2,850	......	......	51	14	4	......	300	14
31	3	......	5,150	1,920	......	......	......	13	......	......	92	......

NOTE.—Daily gage heights, Oct. 29–31 and Nov. 2–7, determined from observations by nearby residents. Discharge estimated, because of missing or unreliable gage heights, from weather records and general observations by residents, as follows: Jan. 1–6, 1,400 second-feet; Jan. 7–15, 725 second-feet; Jan. 16–18, 27,000 second-feet; Jan. 26–29, 54,000 second-feet; Feb. 5–11, 480 second-feet; Feb. 13–22, 450 second-feet; Feb. 23–29, 740 second-feet; Mar. 1 and 2, 400 second-feet; Mar. 4–20, 240 second-feet; Mar. 22–31, 1,030 second-feet; July 13–31, 30 second-feet; Aug. 1–7, 25 second-feet; Sept. 4–13, 320 second-feet.

Monthly discharge of Agua Fria River near Glendale, Ariz., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4	2	2.94	181
November	800	2	39.2	2,330
December	5,150	8	244	15,000
January	....	....	11,400	701,000
February	....	....	577	33,200
March	....	....	505	31,100
April	270	51	149	8,870
May	48	13	27.3	1,680
June	13	4	6.97	415
July	99	3	24.6	1,510
August	300	13	62.1	3,820
September	....	....	120	7,140
The year	....	2	1,110	806,000

NOTE.—See footnote to daily-discharge table.

HASSAYAMPA RIVER NEAR WAGONER, ARIZ.[1]

Location.—In sec. 23,[2] T. 11 N., R. 3 W., at road crossing opposite Shride's ranch (Moore's ranch prior to August 20, 1916), 2½ miles above mouth of Milk Creek, 4½ miles above Wagoner, Yavapai County, 6 miles above Walnut Grove dam site, and about 25 miles northeast of Wickenburg.

Drainage area.—Not measured.

Records available.—November 21, 1912, to September 30, 1916.

Gage.—Vertical staff on right bank; read by Mrs. A. A. Moore from October 1 to August 19 and by E. W. Shride from August 20 to September 30. Auxiliary gage were used from time to time but all were referred to same datum.

Discharge measurements.—Made by wading or from cable.

Channel and control.—Sand and gravel; constantly shifting.

Extremes of discharge.—No reliable records of maximum discharge; channel dry at gage for periods of varying length nearly every year.

Diversions.—Nearly entire low-water flow is diverted for irrigation above station.

Accuracy.—Stage-discharge relation constantly changing. Rating curve not developed. Gage read to half-tenths once daily. Daily discharge not determined.

Discharge measurements of Hassayampa River near Wagoner, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*	Jan. 24	C. C. Jacob	*Feet.* 6.04	*Sec.-ft.* 30.1
Nov. 10	M. D. Anderson	5.30	24.	Aug. 11	Ellsworth and Anderson.	5.38	.4
10	.....do	5.30	25.				

Daily gage height, in feet, of Hassayampa River near Wagoner, Ariz., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.3	5.3	5.3	5.5	6.2	5.6	5.4	4.7	4.3	4.5	5.5	5.8
2	5.25	5.3	5.3	5.5	6.0	5.6	5.35	4.7	4.3	4.5	5.5	5.8
3	5.3	5.3	5.3	5.5	5.9	5.5	5.4	4.7	4.2	4.5	5.7	5.8
4	5.3	5.3	5.3	5.5	5.85	5.5	5.4	4.65	4.2	4.5	5.6	5.8
5	5.3	5.3	5.3	5.5	5.85	5.5	5.4	4.65	4.2	4.5	5.6	5.8
6	5.3	5.45	5.3	5.5	5.9	5.5	5.4	4.6	4.2	4.5	5.85	5.8
7	5.3	5.5	5.3	5.5	5.9	5.4	5.4	4.6	4.15	6.15	5.85	5.8
8	5.3	5.4	5.3	5.5	5.6	5.4	5.4	4.6	4.15	6.5	5.6	5.8
9	5.3	5.4	5.3	5.5	5.5	5.4	5.4	4.6	4.15	6.05	5.5	5.9
10	5.3	5.4	5.3	5.5	5.55	5.5	5.4	4.6	4.15	5.95	5.4	5.9
11	5.3	5.35	5.3	5.5	5.55	5.5	5.4	4.6	4.15	5.8	5.4	5.8
12	5.5	5.35	5.3	5.5	5.6	5.5	5.4	4.6	4.15	5.7	5.6	5.8
13	5.5	5.35	5.3	5.4	5.65	5.4	5.3	4.6	4.15	5.7	5.4	5.8
14	5.5	5.3	5.3	5.4	5.65	5.4	5.25	4.55	4.1	5.6	5.6	5.85
15	5.5	5.3	5.3	5.4	5.7	5.4	5.1	4.55	4.1	5.6	5.6	5.85
16	5.5	5.3	5.3	5.6	5.8	5.4	5.0	4.45	4.1	5.6	5.5	5.9
17	5.4	5.3	5.3	7.4	5.9	5.4	5.0	4.45	4.1	5.55	5.5	5.8
18	5.4	5.3	5.3	7.25	5.6	5.4	5.0	4.45	4.1	5.55	5.4	5.8
19	5.4	5.3	5.4	6.0	5.5	5.45	5.0	4.4	4.1	5.55	5.4	5.8
20	5.3	5.35	5.4	6.0	5.4	5.6	4.9	4.4	4.1	5.55	5.4	5.8
21	5.3	5.3	5.4	6.0	5.8	5.6	4.8	4.4	4.1	5.55	5.4	5.8
22	5.3	5.3	5.4	5.8	5.7	6.0	4.8	4.4	4.1	5.55	5.4	5.8
23	5.3	5.3	5.4	....	5.9	6.2	4.8	4.4	4.1	5.5	5.85	5.8
24	5.2	5.3	5.4	6.0	5.9	6.3	4.7	4.5	4.1	5.5	5.7	5.8
25	5.2	5.3	5.4	6.0	5.9	6.0	4.7	4.5	4.1	5.45	5.8	5.8
26	5.2	5.3	5.4	6.0	6.1	5.9	4.7	4.4	4.1	5.45	5.85	5.8
27	5.3	5.3	5.4	7.0	5.8	5.75	4.7	4.35	4.5	5.4	5.95	5.8
28	5.3	5.3	5.4	10.0	5.85	5.7	4.7	4.5	4.5	5.4	5.85	5.8
29	5.3	5.3	5.4	6.2	5.8	5.7	4.7	4.0	4.5	5.4	5.9	5.8
30	5.3	5.3	5.5	6.2	....	5.6	4.7	4.0	4.5	5.35	5.85	5.8
31	5.3	....	5.5	6.9	....	....	....	3.5	....	5.35	5.8	....

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[1] Records published as "Hassayampa River at Walnut Grove" in Water-Supply Papers 329, 359, and 389. Walnut Grove post office was originally in sec. 2, T. 10 N., R. 3 W., as shown on the topographic map of the Congress quadrangle. Some time prior to the establishment of the gaging station the post office was moved to sec. 23, T. 11 N., R. 3 W., about one-fourth mile above site of gage. It was abandoned in March, 1914, and since then the nearest post office has been Wagoner.

[2] Incorrectly given as "sec. 33" in Water-Supply Papers 329, 359, and 389.

SEEPAGE INVESTIGATIONS ON GILA RIVER.

From April 25 to October 1, 1916, eight series of discharge measurements were made on Gila River from the head of Florence canal to the east line of Gila Indian Reservation to determine the quantity of water lost by seepage and evaporation between those points. All diversions were measured. The results of these measurements are shown in the following table:

Seepage measurements on Gila River from head of Florence canal to east line of Gila River Indian Reservation, during period Apr. 25 to Oct. 1, 1916.

First series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
			Sec.-ft.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
Apr. 25	Gila River	Above Florence canal	717			
25	Florence canal	Intake		70	131	
25	McLellan canal	do		3.7		
25	O. T. canal	do		28.9		
26	Pierson-Nicholas canal	do		13.0		
26	Price and Powell canal	do		1.1		
26	North Side Blackwater canal	do		5.4		
26	Aztec canal	do		9.2		
26	Gila River	Near east line of Gila River Indian Reservation.	403			183

Second series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 2	Gila River	Above Florence canal	778			
2	Florence canal	Intake		82	147	
2	McLellan canal	do		1.5		
2	O. T. canal	do		25.2		
2	Pierson-Nichols canal	do		13.7		
2	Price and Powell canal	do		1.1		
2	North Side Blackwater canal	do		13.4		
2	Aztec canal	do		10.0		
2	Gila River	Near east line of Gila River Indian Reservation.	430			201

Third series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 15	Gila River	Above Florence canal	438			
15	Florence canal	Intake		87	129	
15	McLellan canal	do		3.6		
15	O. T. canal	do		10.3		
15	Pierson-Nicholas canal	do		9.7		
15	Price and Powell canal	do		1.0		
15	North Side Blackwater canal	do		11.2		
15	Aztec canal	do		6.2		
15	Gila River	Near east line of Gila River Indian Reservation.	231			78

Fourth series.

Date.	Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
May 21	Gila River	Above Florence canal	325			
21	Florence canal	Intake		80	114	
21	McLellan canal	do		2.7		
21	O. T. canal	do		19.7		
20	Pierson-Nicholas canal	do		6.4		
20	Price and Powell canal	do		1.6		
20	North Side Blackwater canal	do		1.6		
20	Aztec canal	do		2.2		
20	Gila River	Near east line of Gila River Indian Reservation.	136			75

Seepage measurements on Gila River from head of Florence canal to east line of Gila River Indian Reservation, during period Apr. 25 to Oct. 1, 1916—Continued.

Fifth series.

Date.		Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
				Sec.-ft.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
June	1	Gila River	Above Florence canal	172			
	1	Florence canal	Intake		30.9	60	
	1	McLellan canal	.....do		2.3		
	2	Pierson-Nicholas canal	.....do		14.8		
	2	Price and Powell canal	.....do		3.9		
	2	North Side Blackwater canal	.....do		5.0		
	2	Aztec canal	.....do		3.4		
	2	Gila River	Near east line of Gila River Indian Reservation.	28.5			84

Sixth series.

Date.		Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
June	7	Gila River	Above Florence canal	129			
	7	Florence canal	Intake		61	65	
	7	O. T. canal	.....do		3.4		
	8	Aztec canal	.....do		.8		
	8	Gila River	Near east line of Gila River Indian Reservation.	3.6			60

Seventh series.

Date.		Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
July	18	Gila River	Above Florence canal	132			
	18	Florence canal	Intake		64	91	
	18	McLellan canal	.....do		1.9		
	18	O. T. canal	.....do		9.9		
	19	Pierson-Nicholas canal	.....do		15.2		
	19	Gila River	Near east line of Gila River Reservation.	0			41

Eighth series.

Date.		Stream.	Place of measurement.	Amount in river.	Diversions.	Total amount diverted.	Loss.
Oct.	1	Gila River	Above Florence canal	184			
	1	Florence canal	Intake		48.8	74	
	1	McLellan canal	.....do		4.8		
	1	O. T. canal	.....do		6.2		
	1	Pierson-Nicholas canal	.....do		9.5		
	1	Aztec canal	.....do		4.3		
	1	Gila River	Near east line of Gila River Indian Reservation.	23.2			87

WHITEWATER DRAW BASIN.

WHITEWATER DRAW NEAR DOUGLAS, ARIZ.

Location.—In sec. 10, T. 24 S., R. 27 E., opposite city pumping plant, one-quarter mile above highway bridge, about the same distance above El Paso & Southwestern Railroad bridge, 1 mile above electric railway bridge, and 1¼ miles west of Douglas, Cochise County.

Drainage area.—Not measured.

Records available.—August 24 to October 10, 1911, at electric railway bridge; July 21, 1912, to February 15, 1916, at highway bridge; and February 16 to September 30, 1916, at present location.

Gage.—Vertical and inclined staff on right bank opposite city pumping plant; read by Mrs. L. E. King. Original gage, installed August, 1911, at electric railway bridge, was read until October 10, 1911. On July 21, 1912, the station was moved about three-quarters of a mile upstream to the highway bridge, where gage readings were obtained until February 16, 1916; datum of this gage, which bears no definite relation to gage on the electric railway bridge, was raised 3.00 feet on January 20, 1915. On February 16, 1916, the station was moved one-quarter of a mile upstream to its present location and the gage was set at an independent datum.

Discharge measurements.—Made by wading or from highway bridge.

Channel and control.—Sand and gravel; fairly permanent. The dumping of slag into the channel below the gage has caused backwater at various times at the gages until about July 1, 1916, when a new channel was dug around the slag.

Extremes of discharge.—Maximum stage during year, from flood marks on gage, 9.5 feet during night of July 10 (discharge, determined from extension of rating curve, 1,600 second-feet).

1911–1916: Maximum stage recorded, 13.6 feet at 9 a. m. December 23, 1914 (discharge, determined from extension of rating curve, 3,000 second-feet). Stream is dry or carries less than 0.5 second-feet the greater part of each year.

Diversions.—Some flood water is diverted above station for irrigation; quantity unknown.

Accuracy.—Stage-discharge relation prior to July 11 was affected by smelter slag that was being constantly dumped in channel below the gage. Rating curve used prior to February 17 fairly well defined below 1,000 second-feet; curve used since that date fairly well defined below 65 second-feet; above 65 second-feet its extension is based on the slope of the old curve and may be considerably in error. During periods when the discharge was greater than about one-half second-foot the gage was read to half-tenths twice a day or oftener, but on account of rapidly fluctuating stage considerable error may be introduced in assuming that the mean daily gage height was the mean of the observed gage heights. Daily discharge ascertained by applying daily gage height to rating curve. Records roughly approximate.

Discharge measurements of Whitewater Draw near Douglas, Ariz., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. B. Spiegel	3.25	0.0	Aug. 18	J. B. Spiegel	4.65	63
Nov. 11	.....do		[a] .8	18	.....do	4.61	55
Dec. 9	Jacob and Spiegel		.0	18	.....do	4.46	38.4
Feb. 17	J. B. Spiegel	3.62	[a] .2	18	.....do	4.44	33.3
Mar. 21	.....do	3.58	[a] .1	19	.....do	4.24	12.4
Apr. 27	.....do	4.15	.0	19	.....do	4.24	12.3
July 24	Ellsworth and Spiegel	3.82	[a] .3	30	.....do	4.16	13.3
Aug. 8	J. B. Spiegel	3.70	[a] .1	30	.....do	4.15	13.6
18	.....do	4.65	60				

[a] Discharge estimated.

Monthly discharge of Whitewater Draw near Douglas, Ariz., for the year ending Sept. 30, 1916.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
Jan. 20-28	49.3	880	August	118	7,260
May 1-3	154	916	Sept. 1-21	28.0	1,170
July 11-31	31.6	1,320			

Note.—For periods of no record the stream was either dry or carried less than 0.5 second-foot except possibly for a few hours at a time immediately following showers. Discharge Sept. 5, 15, and 18–20 interpolated. Daily discharge not sufficiently accurate for publication. See "Accuracy" in station description.

MISCELLANEOUS MEASUREMENTS.

In additions to the records of flow obtained at the gaging stations and reported in the preceding pages, many measurements were made at other points, as shown by the following table:

Miscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 6	Blacks Fork	Green River	Approximately in sec. 34, T. 16 N. R. 108 W. About 3 miles above mouth, Wyo.	11.08	1,400
21	do	do	do	11.13	1,340
Aug. 11	do	do	do		87
June 5	Hams Fork	Black Fork	Above mouth near Granger, Wyo.	17.20	604
20	do	do	do	17.05	678
Aug. 15	Fraser River	Grand River	500 feet above St. Louis Creek, Fraser, Colo.		89
15	St. Louis Creek	Fraser River	Mouth, Fraser, Colo.		46
Nov. 3	Brush Creek	Green River	Approximately in sec. 36, T. 3 S., R. 22 E. (Salt Lake base and meridian), at bridge on road from Vernal at Bridgeport, Utah.		[a] 7.0
May 8	Ferron Creek	San Rafael River	Sec. 35, T. 19 S., R. 8 E., at former gaging station known as Ferron Creek near Castledale, Utah.	6.97	128
June 30	do	do	do	6.50	49
Aug. 10	do	do	do	6.40	43
Nov. 18	East Elk Creek	Grand River	Newcastle, Colo	.93	9.7
Oct. 27	Pack Creek	do	Approximately sec. 8, T. 26 S., R. 22 E., on road to Monticello about 8 miles above Moab, Utah.		[a] 1.0
May 9	Muddy Creek	Fremont River	Below head of Thos. S. Johnson ditch, the only diversion above, about at location of former gaging station known as "Muddy River near Emery," Utah.		175
July 1	do	do	do		95
May 9	do	do	NE. ¼ sec. 35, T. 21 S., R. 6 E., at former gaging station known as "Muddy Creek (lower station) near Emery, Utah."		173
July 1	do	do	do		1.0
1	Thos. S. Johnson ditch.	Muddy Creek	Near head of ditch		1.0
June 17	Verdure or South Montezuma Creek.	Montezuma Creek	Sec. 25, T. 34 S., R. 23 E., State road crossing, about 2½ miles below former gaging station, known as "Verdure Creek, near Verdure, Utah."		2.0
Oct. 26	Recapture Creek	San Juan River	SE. ¼ sec. 12, T. 36 S., R. 22 E., at State road crossing and 1 mile below head of San Juan Irrigation Co.'s canal.		.0
Mar. 2	do	do	do		[a] 5.0
6	do	do	do		[a] 12.0
June 17	do	do	do		.3
17	San Juan Irrigation Co.'s canal.	Recapture Creek	do		2.6
Sept. 24	Little Colorado River	Colorado River	100 feet above head of canal, near St. Joseph, Ariz.		35.6
Aug. 26	do	do	Tolchaco, Ariz	2.10	200
Sept. 24	St. Joseph canal	Little Colorado River	30 feet below head of canal, about 4 miles east of St. Joseph, Ariz.		20.5
25	Clear Creek	do	Near mouth, about 4 miles east of Winslow, Ariz.		11.8
June 10	Burro Creek	Williams River	About half a mile west of line between Yavapai and Mohave counties, Ariz.		3.0
July 21	do	do	do	1.00	.8
22	do	do	do		.5

[a] Estimated.

Miscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge
				Feet.	*Sec.-ft.*
Aug. 25	Burro Creek	Williams River	About half a mile west of line between Yavapai and Mohave counties, Ariz.	1.05	3.7
28	do	do	do		12.3
July 23	Neals ditch	Burro Creek	do		.6
July 26	Ash Creek	Virgin River	About in sec. 35, T 40 S., R. 13 W., above Toquerville Springs, Utah.		3.2
Jan. 13	do	do	SW. ¼ sec. 2, T. 41 S., R. 13 W., at the southwest corner of the town of Toquerville, Utah.	0.35	13
Mar. 31	do	do	do	.68	109
May 25	do	do	do	.30	38
July 27	do	do	do		18
26	do	do	NW. ¼ sec. 2, T. 41 S., R. 13 W., below diversions at Toquerville, Utah.		8.6
26	Toquerville Town Springs ditch.	Ash Creek	Head of ditch at Toquerville, Utah.		1.4
26	West side Toquerville fields ditch.	do	do		8.7
26	Unnamed ditch	do	do		4.7
May 25	La Verkin Creek	do	SE. ¼ sec. 14, T. 41 S., R. 13 W., at State road crossing, 2 miles south of Toquerville, Utah.		24
May 26	Savage ditch	Leeds Creek	Sec. 36, T. 40 S., R. 14 W., at head of ditch which diverts on left bank a short distance below gaging station on Leeds Creek.		2.1
26	Leeds ditch	do	Sec. 36, T. 40 S., R. 14 W., at head of ditch which diverts on left bank about a quarter of a mile below gaging station on Leeds Creek.		18
29	Cottonwood Creek	Virgin River	Above head of St. George and Cottonwood canal about 15 miles north of St. George, Washington County, Utah.		9.3
July 12	St. George and Cottonwood canal.	Cottonwood Creek	Near head of canal which diverts on right bank of Cottonwood Creek about 15 miles north of St. George, Utah.	1.32	6.8
May 27	Santa Clara Creek	Virgin River	About in sec. 29, T. 41 S., R. 17 W., above heading of Santa Clara Bench canal; short distance above old smelter at Shem and 10 miles northwest of Santa Clara, Washington County, Utah.		54
Feb. 14	do	do	Sec. 16, T. 42 S., R. 16 W., at former gaging station known as "Santa Clara Creek at Santa Clara, Utah."	0.88	80
Apr. 22	do	do	do		23
May 23	do	do	do	[a].95	34
27	do	do	do	[a].47	33
July 19	do	do	do	[a].82	16
May 28	Central canal or 8-mile flat ditch.	Santa Clara Creek	Sec. 11, T. 39 S., R. 16 W., at flume about half a mile below head of canal and about 1½ miles east of Central, Washington County, Utah.	.98	16
July 19	St. George and Santa Clara south ditch.	Santa Clara Creek	Sec. 21, T. 42 S., R. 16 W., at former gaging station at Santa Clara, Utah.	1.12	9.9
Jan. 15	Gila River	Colorado River	Below mouth of San Carlos Creek near San Carlos, Ariz.		8.6
15	do	do	do		8.8
May 9	do	do	Above diversions near Florence, Ariz.		6.2
27	do	do	do		218
June 12	do	do	do		108
15	do	do	do		91
19	do	do	do		75

[a] Temporary gage; old gage not in main channel.

Miscellaneous discharge measurements in Colorado River drainage basin during the year ending Sept. 30, 1916—Continued.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 8	Gila River	Colorado River	Above diversions near Florence, Ariz.		34.5
12	do	do	do		157
25	do	do	do		194
Aug 2	do	do	do		448
9	do	do	do		240
12	do	do	do		301
Sept. 7	do	do	do		923
19	do	do	do		509
19	do	do	do		507
27	do	do	do		226
27	do	do	do		213
Apr. 20	Mineral Creek	Gila River	Mouth, Kelvin, Ariz.		25.4
20	do	do	do		24.7
15	Florence canal	do	Head of canal near Florence, Ariz.	2.49	63
19	do	do	do		63
29	do	do	do	2.50	81
May 27	do	do	do	2.24	46.9
June 12	do	do	do	2.62	66
July 25	Florence canal	Gila River	Head of canal near Florence, Ariz.	2.94	94
May 27	McLellan canal	do	do	1.60	3.0
July 25	do	do	do	1.61	3.0
Apr. 15	O. T. canal	do	do	1.87	20.3
May 27	do	do	do	1.60	9.1
July 25	do	do	do	1.74	18.0
Apr. 22	Price and Powell canal	do	do		2.7
Mar. 30	Queen Creek	do	1 mile below dam site near Superior, Ariz.		9.8
Sept. 22	North Fork of White River.	White River	Below tailrace of power plant half a mile from Fort Apache Indian School at White River, Navajo County, Ariz.,	2.24	128
22	do	do	do	2.24	127
Aug. 11	Hassayampa River	Gila River	Dam site near Wagner, Ariz., about 5 miles below regular gaging station.	2.85	6.0

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STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART IX.—COLORADO RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, ground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, monographs, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features, as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins, in three volumes:
    A. Pacific slope basins in Washington and Upper Columbia River basin.
    B. Snake River basin.
    C. Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below:

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities of the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Atlanta, Ga., Post Office Building.
Chicago, Ill., 1404 Kimball Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Topeka, Kans., 25 Federal Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Austin, Tex., Capitol Building.
Portland, Oreg., 606 Post Office Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Tucson, Ariz., Univeristy of Arizona.
Honolulu, Hawaii, 14 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,100 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Description, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 2	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	.....do	1903.
W 124 to 135	.....do	1904.
W 165 to 178	.....do	1905.
W 201 to 214	.....do	1906.
W 241 to 252	.....do	1907–8.
W 261 to 272	.....do	1909.
W 281 to 292	.....do	1910.
W 301 to 312	.....do	1911.
W 321 to 332	.....do	1912.
W 351 to 362	.....do	1913.
W 381 to 394	.....do	1914.
W 401 to 414	.....do	1915.
W 431 to 444	.....do	1916.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1916. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1916, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for the Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are presented in order of streams around the rim of the lake.

Number of water-supply papers containing results of stream measurements, 1899-1916.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope basins. (St. John River to York River).	South Atlantic slope and eastern Gulf of Mexico basins. (James River to the Mississippi).	Ohio River basin.	St. Lawrence River and Great Lakes basins.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington and upper Columbia River. basins.	Snake River basin.	Lower Columbia River basin and Pacific slope basins in Oregon.
1899[a]......	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[g]......	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901.......	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 78	66, 75
1902.......	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	55	85
1903.......	97	[b] 97, 98	98	97	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904.......	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905.......	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906.......	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8.....	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909.......	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910.......	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911.......	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912.......	321	322	323	324	325	326	327	328	329	330	331	332–A	332–B	332–C
1913.......	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914.......	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915.......	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916.......	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Gallatin River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific slope basins.

[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables of monthly discharge estimates for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Scioto River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England Rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

PART IX. COLORADO RIVER BASIN.

PRINCIPAL STREAMS.

The largest tributaries of the Colorado River are Green River (considered the continuation of the main stream), Grand River, Dolores, San Juan, Little Colorado, Virgin, and Gila rivers. The principal streams flowing into the Green are East Fork, Yampa River, Ashley Creek, Duchesne River, and White River. The principal tributaries of Grand River are Grand Lake, Frazier River, Williams Fork, Blue River, and Gunnison River. The streams of the Colorado basin drain wholly or in part the States of Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. xxi.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained Sept. 30, 1916. Period after a date indicates discontinuance.

Green River (head of Colorado River) near Kendall, Wyo., 1910–1912.
Green River near Daniel, Wyo., 1915–
Green River at Green River, Wyo., 1895–1906; 1915–
Green River at Bridgeport, Utah, 1911–1915.
Green River at Jensen, near Vernal, Utah, 1903–1906; 1914–1915.
Green River at Ouray, Utah, 1904–5.
Green River at Green River (formerly Blake), Utah, 1894–1899; 1905–1911.
Green River at Little Valley, near Green River, Utah, 1910–
Colorado River at Bulls Head, near Mohave, Ariz., 1902–3.
Colorado River at Hardyville, Ariz., 1905–1907.
Colorado River at Yuma, Ariz., 1891–
  Horse Creek at Daniel, Wyo., 1915–
  Cottonwood Creek near Big Piney, Wyo., 1916–
  East Fork at East Fork canal, Wyo., 1916–
  East Fork at Newfork, Wyo., 1905–6; 1915–
    New Fork at Alexander's ranch, near Cora, Wyo., 1910–11.
    New Fork at Pinedale crossing, near Cora, Wyo., 1905.
    New Fork near Boulder, Wyo., 1915–
      Pine Creek at Fremont Lake outlet near Pinedale, Wyo., 1905–1906; 1910–1912; 1915–
      Pine Creek at Pinedale, Wyo., 1915–
      Pole Creek near Fayette, Wyo., 1904–1906.
      Pole Creek near Pinedale, Wyo., 1910.
        Fall Creek at Fayette, Wyo., 1904–5.
      Boulder Creek near Boulder (Newfork), Wyo., 1904–1906; 1915–
  North Piney Creek near Marbleton, Wyo., 1915–1916.
  Middle Piney Creek near Big Piney, Wyo., 1915–
  Labarge Creek near Labarge, Wyo., 1915–16.

Colorado River tributaries—Continued.

- Fontenelle Creek near Fontenelle, Wyo., 1915–
- Big Sandy Creek at Leckie's ranch, near Big Sandy, Wyo., 1910–11.
- Big Sandy Creek near Eden, Wyo., 1911–12.
- Big Sandy Creek near Farson, Wyo., 1915–
  - Dutch Joe Creek at Dutch Joe ranger station, near Big Sandy, Wyo., 1911–12.
  - Squaw Creek near Eden, Wyo., 1911–12.
  - Little Sandy Creek near Eden, Wyo., 1911–12.
- Blacks Fork near Urie, Wyo., 1913–
- Blacks Fork above Hams Fork, near Granger, Wyo., 1896–97.
- Blacks Fork below Hams Fork at Granger, Wyo., 1897–1900; 1916.
- Henrys Fork near Linwood, Utah, 1916.
- Beaver Creek at Myer's ranch, near Lodore, Colo., 1910–11.
- Vermilion Creek at Bassett's ranch, near Lodore, Colo., 1910–11.
- Yampa River at Yampa, Colo., 1910–1913.
- Yampa River at Steamboat Springs, Colo., 1904–1906; 1910–1913.
- Yampa River at Craig, Colo., 1901–2; 1904–1906; 1910–1913.
- Yampa River near Maybell, Colo., 1904–5; 1910–12; 1916–
  - Terrible Creek:
    - Trout Creek at Pinnacle, Colo., 1910–11.
  - Soda Creek at Steamboat Springs, Colo., 1910–11.
  - Elk River at Hinman Park, Colo., 1912–13.
  - Elk River near Clark, Colo., 1910–1913.
  - Elk River near Trull, Colo., 1904–1906; 1910–1913.
    - Mad Creek near Steamboat Springs, Colo., 1912–13.
  - Sage Creek:
    - Fish Creek at Dunkley, Colo., 1910–11.
  - Elk Head Creek near Craig, Colo., 1906; 1910–1913.
  - Fortification Creek at Craig, Colo., 1905–6; 1910–1913.
  - Williams River near Pyramid, Colo., 1910–11.
  - Williams River at Hamilton, Colo., 1904–1906; 1910–1913.
  - Milk Creek near Axial, Colo., 1904–5.
  - Little Snake River, Middle Fork, near Battle Creek, Colo., 1912–13.
  - Little Snake River at Dixon, Wyo., 1910–1913.
  - Little Snake River near Maybell, Colo., 1904.
    - South Fork of Little Snake River near Battle Creek, Colo., 1912–13.
    - Slater Creek at Baxter ranch, near Slater, Colo., 1912–13.
    - Slater Creek near Slater, Colo., 1910–1912.
    - Savery Creek near Savery, Wyo., 1915–
    - Beaver Creek:
      - Willow Creek near Baggs, Wyo., 1912–13.
    - Muddy Creek near Baggs, Wyo., 1915–
    - Fourmile Creek near Baggs, Wyo., 1912–13.
- Ashley Creek above Dry Fork, near Vernal, Utah, 1911–
- Ashley Creek below Dry Fork, near Vernal, Utah, 1900–1904.
  - Dry Fork of Ashley Creek at Vernal, Utah, 1904.
- Duchesne River, North Fork (head of Duchesne River), above Forks, Utah, 1904.
- Duchesne River at Myton, Utah, 1899–
  - West Fork of Duchesne River above Forks, Utah, 1904.
  - Rock Creek (East Creek), 10 miles above mouth, Utah, 1904.
  - Strawberry River above mouth of Indian Creek, in Strawberry Valley, Utah, 1903–1906; 1909–10.
  - Strawberry River below mouth of Indian Creek, in Strawberry Valley, Utah, 1908–9.

- Colorado River tributaries—Continued.
  - Duchesne River tributaries—Continued.
    - Strawberry River at Duchesne (Theodore), Utah, 1908–1910; 1914–
      - Indian Creek in Strawberry Valley, Utah, 1905–6; 1909–10.
        - Trail Hollow Creek in Strawberry Valley, Utah, 1909–10.
      - Currant Creek, 13 miles above mouth, Utah, 1904.
      - Currant Creek, 3 miles above mouth, Utah, 1904.
        - Red Creek above Narrows, Utah, 1904.
    - Lake Fork, West Fork of (head of Lake Fork), 10 miles above Forks, Utah, 1904.
    - Lake Fork below Forks, Utah, 1904; 1907–1910.
    - Lake Fork near Myton, Utah, 1900–1903; 1907–
      - East Fork of Lake Fork, 8 miles above Forks, Utah, 1904.
    - Uinta River near Whiterocks, Utah, 1899–1904; 1907–1910.
    - Uinta River at Fort Duchesne, Utah, 1899–1904; 1906–1910.
    - Uinta River at Ouray School, Utah, 1899–1904.
      - Whiterocks River near Whiterocks, Utah, 1899–1904; 1907–1910.
  - White River, North Fork (head of White River), near Buford, Colo., 1903–1906; 1910–1913.
  - White River at Meeker, Colo., 1901–1906; 1910–1913.
  - White River at White River City, Colo., 1895.
  - White River at Rangely, Colo., 1904–5.
  - White River near Dragon, Utau, 1906.
  - White River near Ouray, Utah, 1904.
    - Marvine Creek near Buford, Colo., 1903–1906.
    - South Fork of White River near Buford, Colo., 1903–1906; 1910–1913.
  - Price River near Helper, Utah, 1894–95; 1904–
  - Price River at Woodside, Utah, 1909–1911.
  - Huntington Creek (head of San Rafael River) near Huntington, Utah, 1909–
  - Huntington Creek near Castledale, Utah, 1911–
  - San Rafael River near Green River, Utah, 1909–
    - Cottonwood Creek near Orangeville, Utah, 1909–
    - Ferron Creek (upper station) near Ferron, Utah, 1911–
    - Ferron Creek near Ferron, Utah, 1909–1911.
    - Ferron Creek near Castledale, Utah, 1911–1914.
  - Grand River, North Fork (head of Grand River), near Grand Lake, Colo., 1904–
  - Grand River near Granby, Colo., 1908–1911.
  - Grand River at Hot Sulphur Springs, Colo., 1904–
  - Grand River near Kremmling, Colo., 1904–
  - Grand River near Wolcott, Colo., 1906–1908.
  - Grand River at Shoshone, Colo., 1897.
  - Grand River at Glenwood Springs, Colo., 1899–
  - Grand River near Palisades, Colo., 1902–
  - Grand River near Grand Junction, Colo., 1894–1900.
  - Grand River near Fruita, Colo., 1911–
  - Grand River near Cisco, Utah, 1914–
  - Grand River near Moab, Utah, 1913–14.
    - North inlet to Grand Lake at Grand Lake, Colo., 1905–1912.
    - Grand Lake outlet at Grand Lake, Colo., 1904–1913.
    - South Fork of Grand River near Lehman, Colo., 1907–8.
    - Fraser River near Arrow, Colo., 1910–
    - Fraser River at upper station, near Fraser, Colo., 1908–1911.
    - Fraser River at lower station, near Fraser, Colo., 1907–1909.

- Colorado River tributaries—Continued.
  - Grand River tributaries—Continued.
    - Fraser River at Granby (Coulter), Colo., 1904–1909.
      - Big Jim Creek near Fraser, Colo., 1907–1909.
        - Little Jim Creek near Fraser, Colo., 1907–1909.
      - Vasquez Creek at upper station, near Fraser, Colo., 1908–9.
      - Vasquez Creek at lower station, near Fraser, Colo., 1907–1909.
      - Elk Creek near Fraser, Colo., 1907–1909.
      - St. Louis Creek at upper station, near Fraser, Colo., 1908–9.
      - St. Louis Creek at lower station, near Fraser, Colo., 1908–9.
      - North Ranch Creek at upper station, near Rollins Pass, Colo., 1908–9.
      - North Ranch Creek at lower station, near Rollins Pass, Colo., 1907–1909.
        - Middle Ranch Creek at upper station, near Arrow, Colo., 1908–9.
        - Middle Ranch Creek at lower station, near Arrow, Colo., 1907–1909.
          - South Ranch Creek at upper station, near Arrow, Colo., 1908–9.
          - South Ranch Creek at lower station, near Arrow, Colo., 1907–1909.
    - Williams Fork near Scholl, Colo., 1910–
    - Williams Fork near Parshall (Sulphur Springs), Colo., 1904–
    - Troublesome Creek at Troublesome, Colo., 1904–5.
    - Muddy Creek at Kremmling, Colo., 1904–5.
    - Blue River at Breckenridge, Colo., 1914–15.
    - Blue River at Dillon, Colo., 1910–
    - Blue River near Kremmling, Colo., 1904–1908.
      - Spruce Creek (upper station) near Breckenridge, Colo., 1914–15.
      - Spruce Creek (lower station) near Breckenridge, Colo., 1914–15.
      - Crystal Creek near Breckenridge, Colo., 1914–15.
      - Snake River at Dillon, Colo., 1910–
      - Tenmile Creek near Kokomo., Colo., 1904.
      - Tenmile Creek near Uneva Lake, Colo., 1903.
      - Tenmile Creek at Dillon, Colo., 1910–
    - Eagle River at Redcliff, Colo., 1911–
    - Eagle River above Brush Creek, at Eagle, Colo., 1911–
    - Eagle River below Brush Creek, at Eagle, Colo., 1905–1907.
    - Eagle River at Gypsum, Colo., 1907–1909.
      - Turkey Creek at Redcliff, Colo., 1913–
      - Homestake Creek at Redcliff, Colo., 1911–
      - Gore Creek near Minturn, Colo., 1911–1914.
      - Beaver Creek at Avon, Colo., 1911–1914.
      - Brush Creek at Eagle, Colo., 1911–1913.
      - No Name Creek near Glenwood Springs, Colo., 1911–1914.
      - Glenwood Light & Power Co.'s flume near Glenwood Springs, Colo., 1911–1913.
    - Roaring Fork at Aspen, Colo., 1911–
    - Roaring Fork below Aspen, Colo., 1913–
    - Roaring Fork near Emma, Colo., 1908–9.
    - Roaring Fork at Glenwood Springs, Colo., 1906–
      - Hunter Creek at Aspen, Colo., 1911–1913.
      - Castle Creek near Aspen, Colo., 1911–
      - Maroon Creek at upper station, near Aspen, Colo., 1911–
      - Maroon Creek at lower station, near Aspen, Colo., 1914–15.
      - Snow Mass Creek at Snow Mass, Colo., 1911–1913.
      - Fryingpan Creek at Norrie, Colo., 1911–
      - Fryingpan Creek at Thomasville, Colo., 1911–

- Colorado River tributaries—Continued.
  - Grand River tributaries—Continued.
    - Roaring Fork tributaries—Continued.
      - Fryingpan Creek at Basalt, Colo., 1908–9.
        - North Fork of Fryingpan Creek near Norrie, Colo., 1911–
      - Crystal River at Marble, Colo., 1910–
      - Crystal River near Carbondale (Sewell), Colo., 1908–9.
    - Elk Creek, West Fork (head of Elk Creek), near Newcastle, Colo., 1911.
      - Middle Fork of Elk Creek near Newcastle, Colo., 1911–1914.
      - East Fork of Elk Creek near Newcastle, Colo., 1911–1915.
    - West Divide Creek (head of Divide Creek) at Hostetler's ranch, near Raven, Colo., 1909.
    - West Divide Creek at Beard's ranch, near Raven, Colo., 1910–1911.
    - West Divide Creek at Raven, Colo., 1909–11.
    - West Mamm Creek near Rifle, Colo., 1909–10.
    - Taylor River (head of Gunnison River) near Almont, Colo., 1905.
    - Taylor River at Almont, Colo., 1910–
    - Gunnison River near Gunnison, Colo., 1910–1914, 1916–
    - Gunnison River near Iola, Colo., 1900–1903.
    - Gunnison River near Cimarron, Colo., 1903–1905.
    - Gunnison River at River Portal, Colo., 1905–1911.
    - Gunnison River near Cory, Colo., 1903–1905.
    - Gunnison River at Roubideau, Colo., 1897.
    - Gunnison River at Whitewater, Colo., 1895; 1897; 1901–1906.
    - Gunnison River near Grand Junction, Colo., 1894–95; 1897–1899.
      - East River at Almont, Colo., 1905; 1910–
        - Cement Creek near Crested Butte, Colo., 1910–1913.
      - Tomichi Creek near Gunnison, Colo., 1910.
        - Quartz Creek near Pitkin, Colo., 1910–1913.
      - Cimarron Creek at Cimarron, Colo., 1903–1905.
      - North Fork of Gunnison River near Hotchkiss, Colo., 1903–1906.
      - Sapinero Creek at Sapinero, Colo., 1911–1914.
      - Uncompahgre River near Colona, Colo., 1903–1906.
      - Uncompahgre River at Ouray, Colo., 1908; 1911–
      - Uncompahgre River below Ouray, Colo., 1913–
      - Uncompahgre River near Fort Crawford, Colo., 1910–11.
      - Uncompahgre River at Fort Crawford, Colo., 1895–1899; 1908–1910.
      - Uncompahgre River at Montrose, Colo., 1900; 1903–
      - Uncompahgre River near Delta, Colo., 1903–
        - Canyon Creek at Ouray, Colo., 1911–1915.
    - Dolores River at Rico, Colo., 1914.
    - Dolores River at Dolores, Colo., 1895–1903; 1910–1912.
      - Rico Mining Co.'s tailrace at Rico, Colo., 1914.
      - San Miguel River near Fall Creek, Colo., 1895–1899; 1910.
      - San Miguel River at Placerville, Colo., 1910–1912.
    - Mill Creek near Moab, Utah, 1914–
  - Fremont River near Thurber, Utah, 1909–1912.
    - Muddy Creek near Emery, Utah, 1909–1914.
    - Muddy Creek (lower station) near Emery, Utah, 1911–1914.
    - Ivie Creek near Emery, Utah, 1911–12.
  - Escalante Creek (head of Escalante River) near Escalante, Utah, 1909–1913.
  - San Juan River at Pagosa Springs, Colo., 1911–1914.
  - San Juan River at Arboles, Colo., 1895–1899; 1910–1914.
  - San Juan River at Turley, N. Mex., 1907–8.

Colorado River tributaries—Continued.

- San Juan River at Blanco, N. Mex., 1908–1910.
- San Juan River near Bloomfield, N. Mex., 1909–1911
- San Juan River at Farmington, N. Mex., 1904–1906; 1912–1914.
- San Juan River near Shiprock, N. Mex., 1911.
- San Juan River near Bluff, Utah, 1914–
  - Navajo River at Chromo, Colo., 1911–12.
  - Navajo River at Edith, Colo., 1912–1914.
  - Piedra River at Piedra, Colo., 1911–12.
  - Piedra River at Arboles, Colo., 1895–1899; 1910–1914.
  - Los Pinos River near Ignacio, Colo., 1899–1903; 1910–1914.
  - Animas River at Silverton, Colo., 1903.
  - Animas River at Tacoma, Colo., 1908–9; 1911.
  - Animas River above Lightner Creek, at Durago, Colo., 1895–1905.
  - Animas River below Lightner Creek, at Durango, Colo., 1910–1914.
  - Animas River at Aztec, N. Mex., 1904; 1907–1914.
  - Animas River at Farmington, N. Mex., 1912–1914.
  - Animas River near Farmington, N. Mex., 1904–5.
  - Evaporation at Farmington, N. Mex., 1914–15.
    - Hermosa Creek near Hermosa, Colo., 1911–1914.
    - Florida River near Durango, Colo., 1899; 1901–1903; 1910–1912.
    - Aztec Light & Power Co.'s canal at Aztec, N. Mex., 1912–1914.
  - La Plata River at Hesperus, Colo., 1904–1906; 1910.
  - La Plata River at La Plata, N. Mex., 1905–1914.
  - Mancos River at Mancos, Colo., 1898–1901.
    - West Mancos River near Mancos, Colo., 1910–11.
  - Montezuma Creek, North Fork, at Monticello, Utah, 1914–
    - Gordon canal near Monticello, Utah, 1914–1915.
    - Wood high-line canal near Monticello, Utah, 1914–1915.
    - North canal near Monticello, Utah, 1914–1915.
    - Middle canal near Monticello, Utah, 1914–
    - South Fork of North Montezuma Creek near Monticello, Utah, 1914–1915.
      - Pioneer canal near Monticello, Utah, 1914–1915.
      - South canal near Monticello, Utah, 1914–
      - Christensen canal near Monticello, Utah, 1915.
      - Spring (Vaga) Creek near Monticello, Utah, 1914–
        - Davenport and Campbell canal near Monticello, Utah, 1914–1915.
        - Green canal near Monticello, Utah, 1914–
    - Verdure (South Montezuma) Creek near Verdure, Utah, 1914–1915.
  - Little Colorado River at St. Johns, Ariz., 1906–1909.
  - Little Colorado River at Woodruff, Ariz., 1905–1908; 1915.
  - Little Colorado River at Holbrook, Ariz., 1905–1909.
    - Zuni River at Black Rock, N. Mex., 1903–1905; 1908–
    - Silver Creek at Snowflake, Ariz., 1906–1908; 1915–16.
    - Silver Creek at canyon station, near Snowflake, Ariz., 1906.
    - Woodruff ditch at Woodruff, Ariz., 1906.
    - Chevelon Fork near Winslow, Ariz., 1905–1908; 1915–16.
    - Clear Creek near Winslow, Ariz., 1906–1909.
  - Virgin River at Virgin, Utah, 1909–
    - Zion Creek near Springdale, Utah, 1913–14.
    - Ash Creek at Toquerville, Utah, 1915.
    - Leeds (Quail) Creek near Leeds, Utah, 1915–
    - Santa Clara Creek near Central, Utah, 1909–

- Colorado River tributaries—Continued.
  - San Juan River tributaries—Continued.
    - Virgin River tributaries—Continued.
      - Santa Clara Creek at Santa Clara, Utah, 1915.
      - Santa Clara Creek near St. George, Utah, 1909–1913.
        - Town canal at Santa Clara, Utah, 1915.
        - St. George and Santa Clara north canal at Santa Clara, Utah,1915.
        - St. George and Santa Clara south canal at Santa Clara, Utah, 1915.
      - Muddy River at Home ranch, near Moapa, Nev., 1913–
      - Muddy River above Indian reservation, near Moapa, Nev., 1914–
      - Muddy River at railroad pumping plant, near Moapa, Nev., 1914–
      - Muddy River at Weiser ranch, near Moapa, Nev., 1915–
      - Muddy River near Moapa and Logan, Nev., 1904–1906; 1909–10; 1913–14.
      - Muddy River near St. Thomas, Nov., 1913–
  - Williams River near Swansea, Ariz., 1910–1915.
  - Gila River near Cliff, N. Mex., 1914–1917.
  - Gila River near Silver City, N. Mex., 1912–1914.
  - Gila River near Gila, N. Mex., 1914.
  - Gila River near Redrock, N. Mex., 1908–1914.
  - Gila River near Duncan, Ariz., 1914–1915.
  - Gila River at Guthire, Ariz., 1910–
  - Gila River near Solomonville, Ariz.,1914–
  - Gila River at San Carlos, Ariz., 1910–11.
  - Gila River near San Carlos, Ariz., 1899–1905.
  - Gila River near dam site, near San Carlos, Ariz., 1914–
  - Gila River at Kelvin, Ariz., 1911–
  - Gila River near Florence, Ariz., 1914.
  - Gila River near Buttes, Ariz., 1889–90; 1895–1899.
  - Gila River near Sentinel, Ariz., 1913–
  - Gila River at Dome (Gila City), Ariz., 1903–1906.
  - Gila River at mouth, near Yuma, Ariz., 1903.
    - Sunset canal near Duncan, Ariz., 1914–15.
    - Coeper and Martin canal near Duncan, Ariz., 1914–15.
    - Coeper and Windham canal near Duncan, Ariz., 1914–15.
    - Model canal near Duncan, Ariz., 1914–15.
    - Valley canal near Duncan, Ariz., 1914–15.
    - Black and McClesky canal at Duncon, Ariz., 1915.
    - Colmonero canal near Duncan, Ariz., 1914–15.
    - York canal at York, Ariz., 1914–15.
    - San Francisco River near Alma, N. Mex., 1904–1907; 1909–1914.
    - San Francisco River at dam, above Clifton, Ariz., 1911.
    - San Francisco River at Clifton, Ariz., 1910–
      - Whitewater Creek near Mogollon, N. Mex., 1909–1914.
    - Brown canal above wasteway, near Solomonville, Ariz., 1914–15.
    - Brown canal below wasteway, near Solomonville, Ariz., 1914–15.
    - Fourness canal near Solomonville, Ariz., 1914–15.
    - San Jose canal near Solomonville, Ariz., 1914–15.
    - Michellena canal near Solomonville, Ariz., 1914–15.
    - Montezuma canal at Solomonville, Ariz., 1914–15.
    - Union canal near Solomonville, Ariz., 1914–15.
    - Graham canal near Safford, Ariz., 1914–15.
    - Oregon canal near Thatcher, Ariz., 1914–15.
    - Smithville canal near Thatcher, Ariz., 1914–15.

- Colorado River tributaries—Continued.
  - Gila River tributaries—Continued.
    - Bryce canal near Pima, Ariz., 1914–15.
    - Dodge canal at Pima, Ariz., 1914–15.
    - Nevada canal near Pima, Ariz., 1914–15.
    - Curtis canal near Fairview, Ariz., 1914–15.
    - Consolidated canal near Fairview, Ariz., 1914–15.
    - San Carlos River at San Carlos, Ariz., 1910–11; 1914–15.
    - San Pedro River at Lewis Springs (Charleston), Ariz., 1904–1906; 1910–11.
    - San Pedro River at diversion dam, near Fairbank, Ariz., 1911–12.
    - San Pedro River near Fairbank, Ariz., 1912–
    - San Pedro River near Dudleyville, Ariz., 1890.
    - Florence canal near Florence, Ariz., 1914–15.
    - O. T. canal near Florence, Ariz., 1914–15.
    - Price and Powell ditch near Florence, Ariz., 1914–15.
    - Pierson-Nicholas canal near Florence, Ariz., 1914–15.
    - Queen Creek at Whitlow's, near Superior, Ariz., 1896; 1915–
    - Santa Cruz River near Nogales, Ariz., 1907; 1909–
    - Santa Cruz River at Tucson, Ariz., 1905–
      - Rillito Creek near Tucson, Ariz., 1909–
    - Black River (head of Salt River) near Fort Apache, Ariz., 1912–
    - Salt River near Roosevelt, Ariz., 1901–1907; 1912–
    - Salt River below mouth of Cherry Creek near Roosevelt, Ariz., 1906.
    - Salt River 50 miles above Phoenix, Ariz., 1890.
    - Salt River at Arizona dam, Ariz., 1888–1891.
    - Salt River at McDowell, Ariz., 1897–1910.
      - White River at Fort Apache, Ariz., 1912–
        - East Fort of White River at Fort Apache, Ariz., 1912–
      - Tonto Creek near Roosevelt, Ariz., 1901–1904; 1913–
      - Verde River near Clarkdale, Ariz., 1915–
      - Verde River at Camp Verde, Ariz., 1912–
      - Verde River at Childs, near Camp Verde, Ariz., 1911–
      - Verde River near McDowell, Ariz., 1889; 1897–1899; 1901–
        - Beaver Creek at Camp Verde, Ariz., 1912–
    - Agua Fria River near Glendale, Ariz., 1910–
    - Hassayampa River near Wagoner (Walnut Grove), Ariz., 1912–
    - Hassayampa River at Wickenburg, Ariz., 1910–1912.
  - Imperial canal 10 miles below Yuma, Ariz., 1903–1905.
  - Imperial canal (main) near Calexico, Cal., 1904–5.
    - Boundary canal near Calexico, Cal., 1905.
    - Wisteria canal near Calexico, Cal., 1905.
    - Holt canal at Calexico, Cal., 1904–5.
    - Hemlock canal at Calexico, Cal., 1904–5.
    - Alamo channel near Calexico, Cal., 1904.
    - Alamitos canal near Calexico, Cal., 1904–5.
- Whitewater Draw[1] near Douglas, Ariz., 1911–

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[1] Flows into Gulf of California in Mexico.

REPORTS ON WATER RESOURCES OF COLORADO RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water Supply papers are of octavo size.

*2. Irrigation near Phoenix, Ariz., by A. P. Davis. 1897. 98 pp., 31 pls. 15c.

Describes physiographic features, temperature, rainfall, stream flow, soils, and projected irrigation works in Gila River basin; discusses briefly possible use of ground water for irrigation and gives data concerning wells in Pinal and Maricopa counties. Chiefly of historic interest, as indicated by the date of publication.

*33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls. 15c.

Describes conditions existing in 1896-99, available water supply, silt, and reservoir sites (Buttes, Riverside, San Carlos, and Queen Creek); contains section on cement, and treats of irrigable land, distribution canals, and organization of irrigation. Interest chiefly historic.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes various types of canals for irrigation.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along Colorado, Little Colorado, San Juan, Mancos, La Plata, Animas, Los Pinos, Grand, Gunnison, Dolores, Uncompahgre, Lake Fork, Roaring Fork, and Eagle rivers; also brief descriptions of several of the streams.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 5c.

*61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

A second, revised, edition of Nos. 57 and 61 was published in 1905 as Water-Supply Paper 149 (q. v.).

*73. Water storage on Salt River, Arizona, by A. P. Davis. 1903. 54 pp., 25 pls. 20c.

Discusses Verde and Salt River basins and McDowell and Salt River reservoirs.

*74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses drainage and irrigation; gives records of stream flow.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. Contains:

Investigations in Arizona, by A. P. Davis. Describes the proposed storage reservoir on Salt River at the mouth of Tonto Creek.

Salt River Valley Water Users' Association, by B. A. Fowler. Contains Judge Kibbey's address presenting a plan for the organization of the owners of lands to be irrigated.

Topographic work in the Grand Canyon of the Gunnison, by I. W. McConnell. Discusses the proposed diversion of water from Gunnison River into Uncompahgre Valley.

The Colorado River, by J. B. Lippincott.

Colorado River reclamation projects, by E. T. Perkins. Describes the site of the Yuma dam and summarizes the advantages of the Yuma site.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. Superseded by 152.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

104. The underground waters of Gila Valley, Arizona, by W. T. Lee. 1904. 71 pp., 5 pls. 10c.

Presents information concerning the topographic features and surficial geology of the area between The Buttes, 12 miles east of Florence and the junction of the Gila and Salt rivers; treats of the source, amount, quality, and methods of securing the underflow.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts relating to ground waters in Colorado, Nevada, New Mexico, Utah, and Wyoming.

136. Underground waters of Salt River valley, Arizona, by W. T. Lee. 1905. 196 pp., 23 pls. 25c.

Describes the physiography and geology of the Mesa and Pheonix regions, gives many well records, and discusses the amount and chemical character of the ground waters, duty of water, and cost of pumping.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Troxton Canyon flood, Arizona, by E. C. Murphy. Globe flood, Arizona, by O. T. Reedy. La Plata River flood, Colorado, from report of Theo. Tobish.

*149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties) location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet or more in depth; includes all wells listed in Water Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Colorado, Nevada, Utah, New Mexico, and Wyoming.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Contains accounts of floods on Colorado, Green, Grand, Gunnison, San Juan, Little Colorado, Gila, San Francisco, Verde, San Pedro, and Salt Rivers, and of th flow of the Colorado into Salton Sink; gives index to literature on floods on American streams.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analysis; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analysis of waters of Colorado, Green, Grand, Gunnison, Animas, Little Colorado, Gila, San Francisco, Salt, and Verde rivers.

320. Geology and water resources of the Sulphur Spring Valley, Arizona, by O. E. Meinzer and F. C. Kelton, with a section on agriculture, by R. H. Forbes. 1913. 231 pp., 15 pls. 45c.

Describes the physiography and drainage of the region, geologic formations, and geologic history; discusses the seasonal and geographic distribution of rainfall, the occurrence and level of ground waters, the flowing and nonflowing wells, the quality of ground waters, the effect of alkali on plant life and on waters for irrigation, the relation of zones for vegetation to water supply and geographic controls, and the plants used for pumping water; treats also of the early history of agriculture and agricultural methods.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of spring and well waters from Colorado and New Mexico and of mine waters from Dunton, Colo., and Tombstone, Ariz.

365. Ground water in southeastern Nevada, by Everett Carpenter. 1915. 86 pp., 5 pls. 15c.

Describes an area in Clark, Lincoln, White Pine, and Nye counties, drained in part by streams tributary to Colorado River and in part by streams discharging into the Great Basin. Discusses stream, lake, and wind topography; vegetation; crops, and industrial development; rainfall; water in bedrock and unconsolidated sediments; source and permanence of artesian waters, and character and distribution of springs; also the quality of waters for domestic use and for irrigation, and gives analyses. Contains details of water supply by areas in Las Vegas and Virgin river basins and the Great Basin. Gives information in regard to watering places on routes of travel.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c. Contains:

(*b*) Ground water in Paradise Valley, Ariz., by O. E. Meinzer and A. J. Ellis, pp. 51-75, pls. 3-5. Describes an area north of Phoenix, in Maricopa County, between Phoenix Mountains on the west and McDowell Mountains on the east, terminated on the north by a rocky upland, but on the south opening into the Salt River Valley. Discusses briefly physiography and drainage, soil and vegetation, climate, occurrence, source, and disposal of ground water, artesian prospects, quality of water, wells, and irrigation.

380. The Navajo country—a geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah, by Herbert E. Gregory. 1916. 219 pp., 29 pls. 80c.

Contains a historical sketch of the Navajo country and discusses geographic provinces, climate, soil, stream flow, the utilization of the streams, the source of the ground water, springs, wells, and artesian areas: gives a table of geographic names and a bibliography of books and pamphlets examined in connection with the study.

*395. Colorado River and its utilization, by E. C. La Rue. 1916. 231 pp., 25 pls. 50c.

Assembles the principal facts relating to the water resources and gives the result of a study of the "possibility of controlling the flow of the whole river by means of storage reservoirs in order to avoid further danger of overflow to the Salton Sink and to render available for profitable use the enormous quantity of water which now flows unused and largely unusable to the Gulf of California in the form of floods."

396. Profile surveys in the Colorado River Basin in Wyoming, Utah, Colorado, and New Mexico, prepared under the direction of W. H. Herron, acting chief geographer, 1917. 6 pp., 43 pls. 50c.

Consists chiefly of maps showing outlines of river banks, islands, position of rapids, falls, and shoals, and existing dams. The streams to which the surveys relate are fully described in Water-Supply Paper 395.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. Contains:

(*a*) Ground water in San Simon Valley, Arizona and New Mexico, by A. T. Schwennesen, with a section on agriculture, by R. H. Forbes, pp. 1-35, pls. 1-3. 1917.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Ninth Annual Report of the United States Geological Survey, 1887-88, J. W. Powell, Director. 1889. xiii, 717 pp., 88 pls. $2. Contains:

***On the geology and physiography of a portion of northwestern Colorado and adjacent parts of Utah and Wyoming, by C. A. White, pp. 677-712, pl. 88. Describes the canyons of Green, Yampa, Snake, and White rivers.**

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II—Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II—Irrigation. xiv, 395 pp., 30 pls., and maps. $1.25. Contains:

*Hydrography, pp. 1-110. Discusses scope of work, methods of stream measurement, rainfall, and evaporation, and describes the more important streams.

*Engineering, pp. 111-200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201-289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291-343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345-388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II—Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213-361, pls. 58-106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basisns, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II, Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457-533, pls. 35-39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617-740, pls. 48-102. Describes the Agua Fria dam, Arizona, and reservoir projects on Rio Verde, Salt River, Queen Creek, Hassayampa River, and Little Colorado River, Arizona, and in the Tonto basin; gives tables of reservoir capacities and areas.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xix, 498 pp., 159 pls., 8 maps in separate case. $2.80. Contains:

*White River Plateau timber land reserve, by G. B. Sudworth, pp. 117-179, pls. 49-58. Battlement Mesa forest reserve, by G. B. Sudworth, pp. 181-243, pls. 59-75. Describes briefly the streams and lakes in the reserves.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*56. Geography and geology of a portion of southwestern Wyoming, with special reference to coal and oil, by A. C. Veatch. 1907. 178 pp., 26 pls. 60c.

Covers the southwest corner of Wyoming and a small adjacent portion of Utah. Gives a detailed description of the geology and a brief discussion of the water-bearing formations Includes a geologic map with structure contours.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated record of well in Sweetwater County, Wyo.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arizona, California, Colorado, New Mexico, Utah and Wyoming and detailed record of well near Phoenix, Maricopa County, Ariz. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

*350. Geology of the Rangely oil district, Rio Blanco County, Colorado with a section on the water supply, by H. S. Gale, 1908. 61 pp., 4 pls. 20c.

Discusses White River and its tributaries as sources of water supply and the possibility of obtaining artesian flows; treats of the quality of the water of White River and gives analyses.

*352. Geologic reconnaissance of a part of western Arizona, by W. T. Lee, with notes on the igneous rocks of western Arizona, by Albert Johannsen. 1908. 99 pp. 11 pls. 25c.

Describes the geography and geology and contains a geologic sketch map of western Arizona north of longitude 33° 30′, including the valley of Colorado River and Hualpai, Big Sandy, Detrital-Sacramento, Williams, and McMullen valleys. Contains a section on water supplies, which includes well data and discussion of ground-water prospects.

*531. Contributions to economic geology, 1911, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1913. 361 pp., 24 pls. 45c.

Issued also in separate chapters. The following papers contain information on ground water: *(c) Geology and petroleum resources of the De Beque oil field, Colo., E. G. Woodruff (pp. 54-68, Pl. VI). Contains a description of the geology and a geologic map of a square area covering Tps. 7 and 8 S., Rs. 97 and 98 W., in the vicinity of De Beque in Mesa and Garfield counties. Includes a brief statement on artesian water in the area (p. 61).

*541. Contributions to economic geology, 1912, Part II, Mineral fuels; M. R. Campbell, geologist in charge. 1914. 532 pp., 29 pls. 50c.

Issued also in separate chapters. The following paper contains information on ground water (*d*) Oil and gas near Green River, Grand County, Utah, by C. T. Lupton (pp. 115-133, Pl. VI). Describes the geology and contains a geologic map of an area of about 300 square miles southeast of the town of Green River. Contains meager data in regard to wells, water supplies. and artesian conditions (pp. 117-123).

*543. Geology and geography of a portion of Lincoln County, Wyo., by A. R. Schultz. 1914. 141 pp., 11 pls. 50c.

Describes the geology and contains a geologic map of an area in the central part of Lincoln County, between Green River and the Salt River Range (Tps. 22-39 N., Rs. 113-117 W.) Includes a brief discussion of ground water and artesian prospects (pp. 134, 135).

628. Geology and coal resources of Castle Valley, in Carbon, Emery, and Sevier counties, Utah, by C. T. Lupton. 1916. 88 pp., 12 pls. 20c.

Describes the geology and contains a geologic map of an area lying between the Wasatch Plateau and the San Rafael Swell, in east-central Utah, and extending from the vicinity of Mounds, on the Denver & Rio Grande Railroad, southwestward about 80 miles. Describes the drainage and water resources, including the prospects of finding water in the Dakota sandstone and underlying McElmo formation.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United State the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and alleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy, except folio 193, which sells for 75 cents a copy. A discount of 40 per cent is allowed on an order for geologic folios amounting to $5 at the retail price—that is, 20 of the 25-cent folios (or their equivalent in higher priced folios) will be sold for $3. The discount is allowed on an order for folios alone, either of one kind or in any assortment, or for folios together with topographic maps, but no discount is allowed on the damaged folios sold at 5 cents each.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

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[1] Index maps showing areas in the Colorado River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

An asterisk (*) indicates that the Geological Survey's stock of the folio is exhausted.

*111. Globe, Arizona.

112. Bisbee, Arizona. 25c. Reprinted in 1914.

*120. Silverton, Colorado.

*129. Clifton, Arizona.

Gives analyses of spring water from San Francisco River.

*130. Rico, Colorado.

*153. Ouray, Colorado.

Describes the river waters used for irrigation, the underground waters, and the thermal springs; gives analyses of water from Hot Spring at Ouray.

171. Engineer Mountain, Colorado. 5c.

199. Silver City, New Mexico. 25c.

"The Continental Divide passes through the quadrangle from its southwest to its north east corner. All northerly drainage reaches Gila River and ultimately the Gulf of California and the Pacific Ocean. All southerly drainage flows toward the Rio Grande," but is lost in the sands of a desert region. The underground-water resources are discussed by N. H. Darton. The discussion of the surface waters is restricted to Mimbres River, one of the southward-flowing streams.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the Colorado River basin are the reports of the State engineers of Colorado, Nevada, New Mexico, and Wyoming, and the annual reports of the United States Reclamation Service. The following reports deserve special mention:

Canyons of the Colorado, by J. W. Powell. 1895. A popular, revised, and enlarged edition of his original journal of exploration, which appeared as part of a report entitled "Exploration of the Colorado River of the West and its tributaries, explored in 1869, 1870, 1871, and 1872," published by the Smithsonian Institution in 1875.

A canyon voyage; the narrative of the second Powell expedition down the Green-Colorado River from Wyoming, and the explorations on land, in the years 1871–72, by Frederick S. Dellenbaugh, artist and assistant topographer of the expedition. 1908.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the chief of engineers, together with a report of Capt. Chittenden. 55th Cong., 2d sess., House Doc. 141. 1898.

Irrigation pumping in Nevada, etc., by Charles A. Norcross: Nevada bureau of industry, agriculture, and irrigation Bull. 8, 1913.

Report of irrigation investigations in Utah under the direction of Elwood Mead: U. S. Dept. Agr. Office Exper. Sta., Bull. 124, 1903.

Irrigation in Utah, Utah Irrigation Commission, 1894.

Irrigation and agricultural practice in Arizona, by R. H. Forbes: Univ. Arizona Agr. Exper. Sta. Bull. 63, 1911.

Ground-water supply and irrigation in Rillito Valley, Arizona: Univ. Arizona, College of Agriculture, Exper. Sta., Bull. 64, 1910.

Oil engines for pump irrigation and the cost of pumping, by G. E. P. Smith: Univ. Arizona Agr. Exper. Sta. Bull. 74, 1915.

The lower Colorado River and the Salton Basin, by C. E. Grunsky: Am. Soc. Civil Eng. Trans., vol. 59, pp. 1–51; discussion, pp. 52–62, December, 1907.

Irrigation and River control in the Colorado River delta, by H. T. Cory: Am. Soc. Civil Eng. Trans., vol. 76, pp. 1204–1453; discussion, pp. 1454–1571, December, 1913.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines, also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden City, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, compares wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachuetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901-2. See also Nos. 64, 94, and 95.

*64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing wells; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall run-off, and evaporation formulas; discusses effects of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this report should be addressed to the U. S. Reclamation Service.]

Contains the following papers of more or less general interest:
Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statues become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1094; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Appproximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., and the contamination of rock wells and of streams by waste oil and brine.

*114. Underground waters of eastern United States: M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amounts, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drill wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c. [Requests for this report should be addressed to the Reclamation Service.]

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation of stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.

*150. Weir experiments, coefficients, and formula, R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

*152. A review of the laws forbidding pollution of inland waters in the United States, second edition, by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuations due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists publications relating to ground waters, and contains the following brief reports of general interest:

- Significance of the term "artesian," by Myron L. Fuller.
- Representation of wells and springs on maps, by Myron L. Fuller.
- Total amount of free water in the earth's crust, by Myron L. Fuller.
- Use of fluorescein in the study of underground waters, by R. B. Dole.
- Problems of water contamination, by Isaiah Bowman.
- Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage disposal problem, by C. E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification and treatment of sewages and tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and of resulting litigation; discusses effect of acid-iron liquors on sewage purification processes; recovery of copperas from acid iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer and glue.

236. The quality of surface waters in the United States: Part I. Analyses of waters east of the one hundreth meridan, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

*258. Underground- water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March- April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage well shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914.

(c) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77-84.

(e) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117-130.

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131-139.

*400. Contributions to the hydrology of the United States, 1916. N. C. Grover, chief hydraulic engineer. 1917. 108 pp., 7 pls. —c. Contains:

(*a*) The people's interest in water-power resources, by G. O. Smith, pp. 1-8.
(*c*) The measurement of silt-laden streams, by R. C. Pierce, pp. 39-51.
(*d*) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

416. The divining rod, a history of water witching, with a bibliography, by A. J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continuously being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

(*c*) Hydraulic conversion tables and convenient equivalents, pp. 71-94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883-84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125-173, pl. 21. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363-561, pls. 107 to 146. See Water-Supply Paper 87.

Thirteenth Annual Report of the United States Geological Survey, 1891-92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101-349, pls. 111 to 146. Discusses the economic aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892-93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W J McGee, pp. 1-47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49-88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analyses of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897-98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59-294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium and through sand, sandstones, and silts; discusses results obtained by other investigators and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295-384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee River basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris." A highly technical report.

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses.

*319. Summary of the controlling factors of artesian flows, by M. L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

616. The data of geochemistry (third edition), by F. W. Clarke. 1916. 821 pp. 45c.

Earlier editions were published as Bulletins 330 and 491. Contains a discussion of the statement and interpretation of water analyses and a chapter of "Mineral wells and springs" (pp. 179-216). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water analyses.

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DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 440

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART X. THE GREAT BASIN

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Prepared in cooperation with the States of
UTAH, NEVADA, CALIFORNIA, OREGON, AND WYOMING

WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

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SURFACE WATER SUPPLY OF THE GREAT BASIN, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting records or measurements of flow made on streams in the United States during the year ending September 30, 1916.

The data presented in these reports were collected by the United States Geological Survey under the following authority contained in the organic law (20 Stat. L., p. 394):

> *Provided*, That this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal years ending June 30, 1895–1917.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 16.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points.

In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 11).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," a term used to designate the section or sections of the stream channel below the gage which determines the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a gaging station is that point on the gage—the gage height—to which the surface of the river falls when the discharge is reduced to zero.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off in inches.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For a part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off in millions of cubic feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.02	10.37	10.71
5	.4320	12.10	12.53	12.96	13.39
6	.5184	14.51	15.04	15.55	16.07
7	.6048	16.93	17.54	18.14	18.75
8	.6912	19.35	20.05	20.74	21.42
9	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1...........	0.6463	18.10	18.74	19.39	20.04
2...........	1.293	36.20	37.48	38.78	40.08
3...........	1.939	54.30	56.22	58.17	60.12
4...........	2.585	72.40	74.96	77.56	80.16
5...........	3.232	90.50	93.70	96.95	100.2
6...........	3.878	108.6	112.4	116.3	120.2
7...........	4.524	126.7	131.2	135.7	140.3
8...........	5.171	144.8	149.9	155.1	160.3
9...........	5.817	162.9	168.7	174.5	180.4

Note.—For part of a month multiply the run-off for one day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

[1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1.4666 feet per second. In computing the table the figures 0.68182 and 1.4667 were used.]

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0..................	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1..................	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2..................	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3..................	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4..................	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5..................	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6..................	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7..................	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8..................	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9..................	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

[1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0..................	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1..................	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2..................	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3..................	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4..................	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5..................	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6..................	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7..................	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8..................	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9..................	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of March 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year (365 days) covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year (365 days) equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the first of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up; at the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for a year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations (Pl. I, *B*) consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder (Pl. II) that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter by the general methods outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements, rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the daily discharge from which the monthly and yearly means of discharge are determined

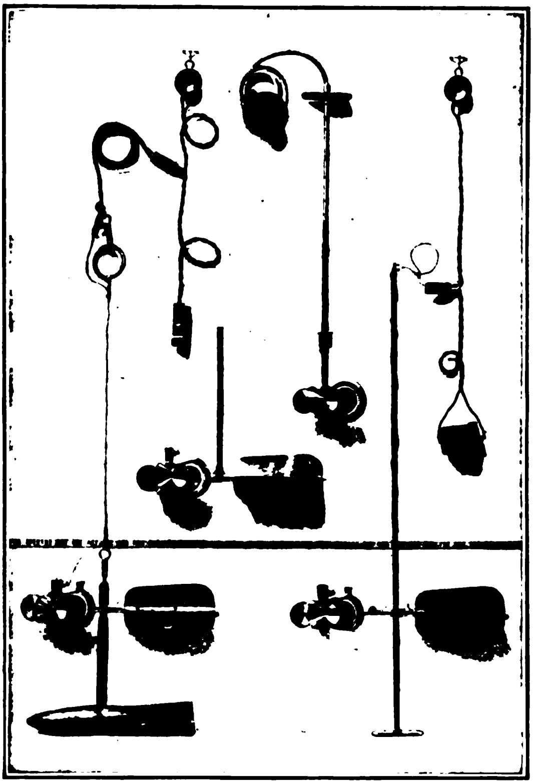
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving records of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off

If the base data are insufficient to determine the daily discharge, tables giving daily gage height and records of discharge measurements. are published.

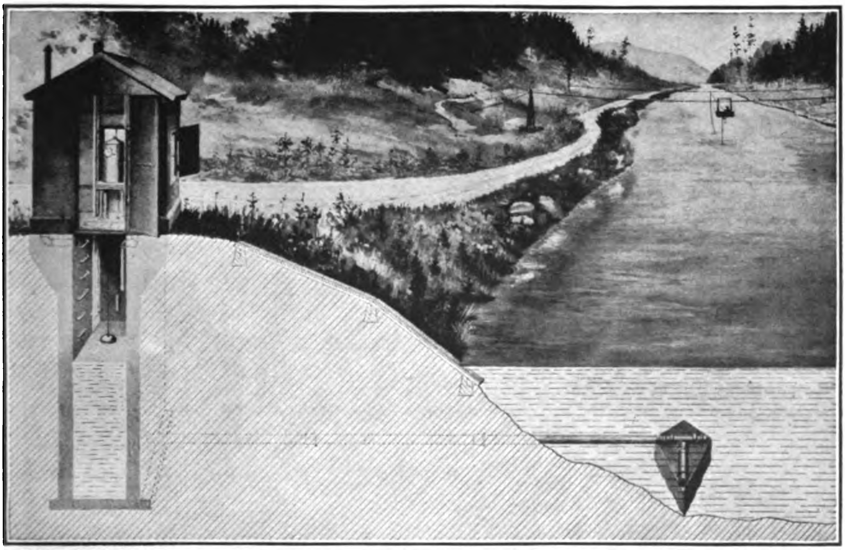
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the permanence of the stage-discharge relation covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of channel, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge is obtained by averaging the discharge at regular intervals during the day or by use of the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

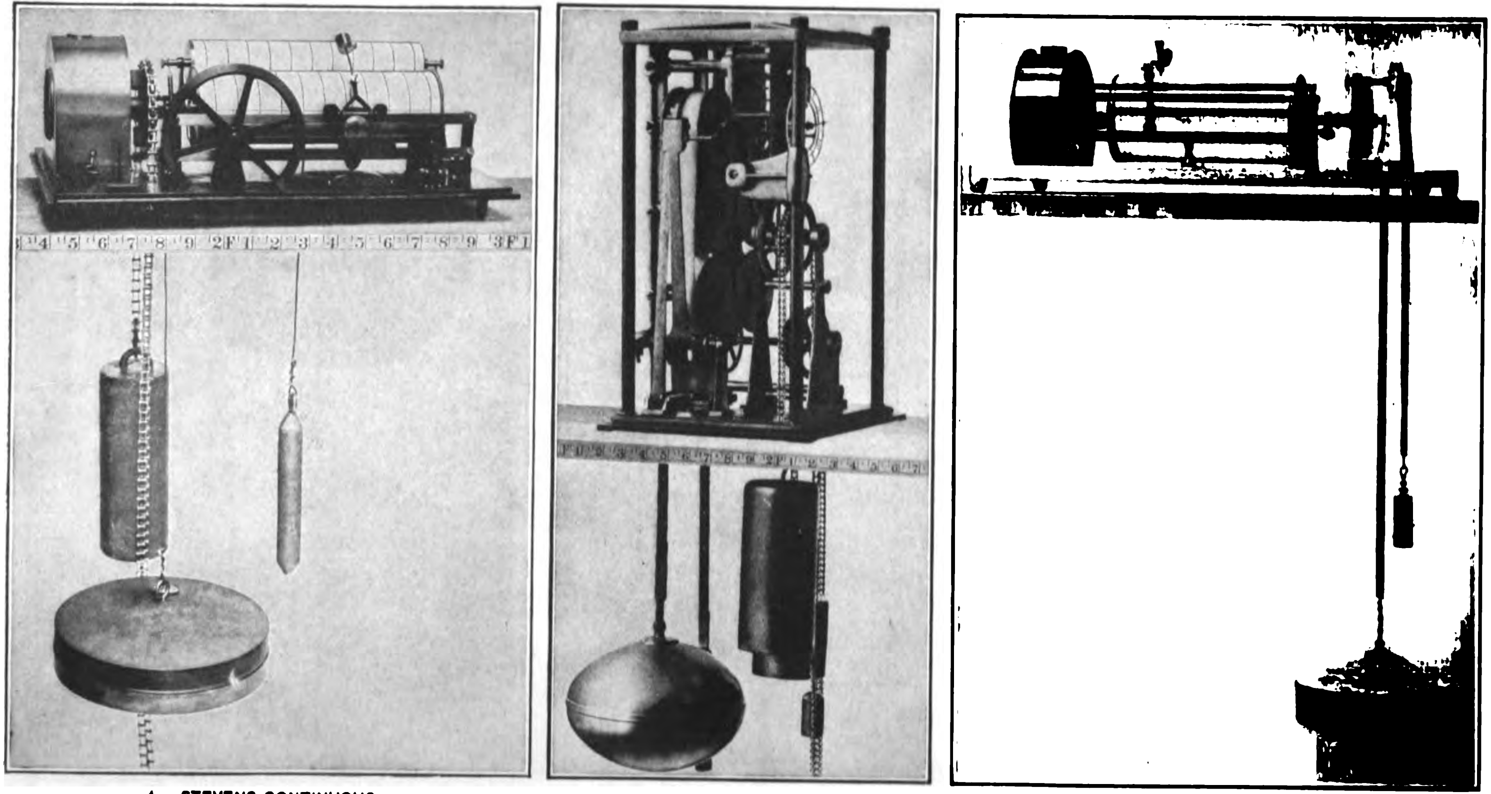
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.

B. GURLEY PRINTING.

C. FRIEZ.

WATER-STAGE RECORDERS.

the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 10, are based.

ACCURACY OF FIELD DATA AND COMPUTED RECORDS.

The accuracy of stream-flow data depends primarily (1) on the permanence of the stage-discharge relation and (2) on the accuracy of observation of stage, measurement of flow, and interpretation of records.

A paragraph in the description of the station gives information regarding the (1) permanence of the stage-discharge relation (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage height to the rating table to obtain the daily discharge.

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depths in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than preliminary estimates; the tables of daily discharge allow more detailed studies of the variation in flow. It should be borne in mind, however, that the observations in each succeeding year may be expected to throw new light on data previously published.

COOPERATION.

During the year ending September 30, 1916, the work in Utah, Nevada, California, Oregon, and Wyoming has been done under cooperative agreements between the United States Geological Survey and the respective States.

Cooperation with the States is effected under contracts which are made between the Director of the Federal Survey and the State engineers or other officials and are authorized by legislative acts appropriating moneys. The State contracts are essentially of the same order, the principal provisions being substantially as follows:

1. The United States Geological Survey retains direct supervision of the field work and the preparation of the data for publication.
2. The Federal Survey retains possession of field notes, maps, and other material collected, but this material is open at all times to inspection by the State officials, and if not satisfactory the agreements can be terminated at any time.
3. The salaries of gage observers and engineers and the traveling and field expenses of the engineers are divided between the two parties in some manner agreed upon, the accounts being rendered monthly in accordance with the regulations of the Federal Survey.
4. The streams and localities in which investigations shall be made are determined by conference between the State officials and the representatives of the United States Geological Survey.
5. The cost of publication is borne entirely by the Federal Survey.

In general, the cooperative agreements specify that the United States Geological Survey shall allot from its appropriation a sum equal to that appropriated from State funds.

Special acknowledgments are due to W. D. Beers, State engineer of Utah; W. M. Kearney, State engineer of Nevada; W. F. McClure, State engineer of California; the State Water Commission of California, W. A. Johnston, president; John H. Lewis, State engineer of Oregon; and James B. True, State engineer of Wyoming, for the very efficient manner in which they have represented their States in the cooperative investigations.

Acknowledgments are also due to the officials and employees of the United States Reclamation Service, the United States Forest Service, the United States Office of Indian Affairs, and the United States Weather Bureau for free use of data collected by them.

Financial assistance has been rendered by the Utah State Agricultural College; Salt Lake City Corporation; Department of Public Service, Los Angeles, Cal.; Southern Pacific Co.; Utah Power & Light Co.; Logan, Hyde Park & Smithfield Canal Co.; Logan Northern Canal Co.; Logan River Water Users' Association; Blacksmith Fork Water Users' Association; Beaver County Irrigation Co.; Elko-Lamoille Light & Power Co.; Humboldt-Lovelocks Irrigation, Light

& Power Co.; Chewacan Land & Cattle Co.; Northwest Townsite Co.; Harney Basin Development Co.; Eastern Oregon Live Stock Co. (successor to the Wm. Hanley Co.); various canal and reservoir companies operating in Sevier River basin; George L. Swendsen; and Joseph Tognoni.

DIVISION OF WORK.

Data for stations in Utah and Nevada were collected and prepared for publication under the direction of E. A. Porter and C. C. Jacob, district engineers, assisted by Lynn Crandall, A. B. Purton, L. W. Jordan, J. J. Sanford, W. E. Dickinson, C. W. Bennett, and Miss Ruby Christensen.

For stations in California the data were collected and prepared for publication under the direction of H. D McGlashan, district engineer, assisted by J. H. Morgan, Char'es Leidl, J. F. Kunesh, J. E. Jones, H. J. Tompkins, Thad McKay, and M. B. Trelease.

For stations in Oregon the data were collected and prepared for publication under the direction of F. F. Henshaw, district engineer, assisted by C. L. Batchelder, J. E. Stewart, P. V. Hodges, and R. C. Briggs.

For stations in Idaho the data were collected and prepared for publication under the direction of G. C. Baldwin, district engineer, assisted by A. W. Harrington, L. W. Roush, William Kessler, Miss E. H. Haugse, and H. J. Dean.

For the station in Wyoming the data were collected and prepared for publication under the direction of Robert Follansbee, district engineer, by H. W. Fear, R. H. Fletcher, H. K. Smith, and Miss Jane Hanna.

The records were reviewed and the manuscript assembled by W. E. Dickinson.

GAGING-STATION RECORDS.

GREAT SALT LAKE BASIN.

GAGES ON GREAT SALT LAKE.

LOCATION.—At Saltair, on the southeastern shore of the lake about 15 miles west of Salt Lake City, and at Midlake, on the Lucin cut-off of the Southern Pacific Railroad, about 30 miles west of Ogden, Weber County, Utah.

RECORDS AVAILABLE.—September 14, 1875, to December 15, 1899; March to July, 1904; October 1, 1912, to September 30, 1916. Records have appeared in publications of United States Geological Survey, as follows: Gage heights September 14, 1875, to January 4, 1890, in Monograph I, "Lake Bonneville," by G. K. Gilbert; gage heights September, 1875, to December, 1891, in the Thirteenth Annual Report of the Director, Part III; gage heights September 14, 1875, to December 15, 1899, in Water-Supply Paper 38; gage heights March 9 to July 21, 1904, in Water-Supply Paper 133; since October 1, 1912, gage heights have been published in water-supply papers. Chart showing variation in level of Great Salt Lake and monthly and annual precipitation in Great Salt Lake basin from 1850 to 1913 compiled from chart in office of chief engineer of Oregon Short Line Railroad, Salt Lake City, Utah, published by United States Geological Survey in Water-Supply Paper 330.

Gages.—Midlake gage read August 15, 1902, to September 30, 1916; Saltair gage July 1, 1903, to September 30, 1916. The first gage was installed at Blackrock in September, 1875, and was used until October, 1877. A gage at Farmington was used from November, 1877, to November, 1879, and one at Lake Shore from November, 1879, to September, 1881. Gages at Garfield Landing were used April, 1881, to December, 1899. In 1916, E. C. LaRue, hydraulic engineer, United States Geological Survey, installed a gage at Lake Point and by means of comparative readings for one month determined the relation between this gage and the gages at Saltair and Midlake. The elevation of the zero of the gage at Lake Point was determined from United States Geological Survey bench marks, the elevations of which had been adjusted in 1912 by the United States Coast and Geodetic Survey from precise leveling. From the Lake Point gage and the table of elevations given by G. K. Gilbert in Monograph I, Mr. LaRue determined the elevations above mean sea level of the zeros of the various gages to be as follows:

Blackrock	4,208.30
Farmington	4,206.80
Lake Shore	4,203.00
Garfield Landing (U. S. G. S.)	4,198.40
Garfield (Marcus E. Jones)	4,198.40
Midlake	4,198.01
Saltair	4,196.77

Accuracy.—Midlake gage read twice a month in inches and readings reduced to feet and tenths. Saltair gage read twice a month to feet and tenths.

Cooperation.—Readings on the Midlake gage are furnished by the Southern Pacific Co.; readings on the Saltair gage by the United States Weather Bureau.

Gage height in feet, of Great Salt Lake, Utah, for the year ending Sept. 30, 1916.

Day.	October.		November.		December.		January.		February.		March.	
	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.
1	4.7	3.5	4.5	3.2	4.5	3.2	4.5	3.3	4.7	3.4	5.2	3.8
15	4.6	3.3	4.5	3.2	4.5	3.2	4.6	3.3	5.0	3.6	5.4	4.0

Day.	April.		May.		June.		July.		August.		September.	
	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.	Saltair.	Midlake.
1	5.6	4.3	6.0	4.7	5.9	4.8	5.7	4.4	5.3	4.2	4.7	3.7
15	5.7	4.5	6.0	4.8	5.8	4.6	5.5	4.3	5.1	3.9	4.5	3.4

BEAR RIVER BASIN.

BEAR RIVER NEAR EVANSTON, WYO.

Location.—In sec. 1, T. 15 N., R. 121 W., 300 feet above highway bridge and 3½ miles northwest of Evanston, Uinta County. Nearest tributary a small stream entering from the southwest half a mile above.

Drainage area.—645 square miles (measured on topographic map and on map issued by the United States Geological Survey, scale 1 to 500,000).

Records available.—October 26, 1913, to September 30, 1916.

Gage.—Chain gage on left bank 300 feet above bridge; read by Mrs. Marion McClure.

Discharge measurements.—Made by wading or from cable just below gage.

Channel and control.—Bed composed of coarse gravel. Control at riffle a short distance below gage; permanent. Left bank is overflowed at stage about 5 feet. the amount of overflow increasing with the stage; right bank is also overflowed at stage above 5 feet, but to a much less extent than left bank.

Extremes of discharge.—Maximum stage recorded during year, 4.90 feet at 5.30 p. m. May 9 (discharge, 1,670 second-feet); minimum stage occurred September 3, when water was below gage (probable gage height, 0.80 foot; discharge about 6 second-feet).

1913–1916: Maximum stage recorded, 5.9 feet at 7 p. m. May 24, 1914 (discharge, 2,480 second-feet); channel reported nearly dry August 15, 1915.

Ice.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

Diversions.—Prior to December 1, 1916, there were adjudicated diversions of 249 second-feet from Bear River in Wyoming above station and 516 second-feet below.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent except as affected by ice. Rating curve well defined between 25 and 1,700 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Bear River near Evanston, Wyo., during the year ending Sept. 30, 1916.

Date	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	R. H. Fletcher	1.33	77	June 7	R. H. Fletcher	4.40	1,340
May 18	H. K. Smith	3.08	634	Aug. 9	H. K. Smith	1.38	76

Daily discharge, in second-feet, of Bear River, near Evanston, Wyo., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	115	55	53		345	790	1,170	277	18	25
2	103	65	58		840	690	995	277	18	21
3	96	56			640	690	995	277	26	8
4	82	63			481	840	1,050	217	30	12
5	105	63			382	1,110	1,230	178	52	16
6	85	69			382	1,230	1,350	156	91	12
7	89	72			345	1,410	1,350	156	102	9
8	92	62			382	1,530	1,470	110	84	10
9	75	62			546	1,600	1,530	165	69	8
10	69	63			592	1,600	1,530	156	70	23
11	62	58			1,170	1,230	1,600	121	64	44
12	66	53			995	1,230	1,530	110	54	39
13	72	51			840	1,050	1,350	89	56	33
14	72	55			740	890	1,470	95	52	41
15	75	56			690	740	1,350	95	54	23
16	92	63			740	502	1,230	82	55	18
17	85	68			690	640	1,230	88	58	17
18	79	63			690	592	1,230	81	55	23
19	82	69			592	640	1,230	58	51	21
20	75	66		1,050	382	640	1,050	52	49	18
21	63	58		1,230	481	569	940	44	51	20
22	63	59		1,170	420	569	840	32	41	26
23	58	69		1,290	460	546	690	25	38	24
24	58	63		1,050	524	640	592	23	24	21
25	61	66		995	592	546	502	15	24	21
26	55	69		546	740	524	382	16	21	15
27	55	69		345	790	546	382	23	21	21
28	61	55		460	1,050	592	345	33	23	22
29	55	55		364	1,170	740	294	30	20	21
30	53	52		262	890	995	277	17	33	17
31	59			310		1,110		24	26	

Note.—Discharge interpolated Aug. 15. No gage-height record Dec. 3 to Mar. 19.

Monthly discharge of Bear River near Evanston, Wyo., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean	
October	115	53	74.6	4,590
November	72	51	61.2	3,640
March 20–31	1,290	262	756	18,000
April	1,170	345	653	38,900
May	1,600	502	872	53,600
June	1,600	277	1,040	61,900
July	277	15	101	6,210
August	102	18	46.1	2,830
September	44	8	21.0	1,250

BEAR RIVER AT HARER, IDAHO.

Location.—In SE. ¼ sec. 22, T. 14 S., R. 45 E., three-fourths mile north of Harer siding on Oregon Short Line Railroad, Bear Lake County, 7 miles by road above Dingle, and 14 miles southeast of Montpelier.

Drainage area.—2,780 square miles (determined by Utah Power & Light Co.).

Records available.—June 21, 1913, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank; installed August 24, 1914; inspected by employees of Utah Power & Light Co. Inclined staff on right bank about 1,500 feet downstream prior to August 24, 1914; control different from that of present gage.

Discharge measurements.—Made by wading or from cable just below gage.

Channel and control.—Bed composed of clean, hard material. Banks are overflowed at extremely high stages. Control permanent during 1915 and 1916.

Extremes of discharge.—Maximum stage recorded during year, 10.23 feet at 8 p. m. March 22 (discharge, 3,630 second-feet); minimum stage recorded, 3.13 feet, October 12–13 (discharge, 192 second-feet); minimum discharge probably occurred during winter.

1913–1916: Maximum stage recorded March 22, 1916; minimum stage recorded, 2.90 feet, 2 a. m. to 1 p. m., September 3, 1915 (discharge, 127 second-feet).

Ice.—Stage-discharge relation seriously affected by ice from November to March. Winter flow determined from current-meter measurements and from charts of water-stage recorder.

Diversions.—No large diversions above station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined above 300 second-feet by measurements made in 1916 and those made by Survey engineers in 1915; measurements made by Karl Gilgen prior to 1916 believed to show too great a discharge. Operation of water-stage recorder satisfactory except for short periods November to March. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting recorder graph. Records good except those for November to March, which, owing to effect of ice, are somewhat uncertain.

Cooperation.—Gage-height record furnished and most of the discharge measurements made by Utah Power & Light Co.

Discharge measurements of Bear River at Harer, Idaho, during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	6	Karl Gilgen	3.16	227	Apr.	7	Karl Gilgen	5.70	1,260
	13	do	3.13	209		13	Gilgen and Baldwin	6.16	1,500
	20	do	3.36	280		13	G. C. Baldwin	6.17	1,500
	28	do	3.28	263		20	Karl Gilgen	6.43	1,590
Nov.	3	do	3.27	262		27	do	6.29	1,540
	10	do	3.29	260	May	4	do	7.27	2,020
	18	do	[a] 3.48	292		11	do	8.14	2,420
	24	do	3.31	265		18	do	6.98	1,860
Dec.	2	do	[a] 3.27	197		25	do	6.27	1,500
	7	do	[a] 3.43	245	June	1	do	5.41	1,130
	14	do	[a] 3.47	275		8	do	6.10	1,470
	16	G. C. Baldwin	[a] 3.38	205		15	do	6.98	1,890
	21	Karl Gilgen	[a] 3.25	200		22	do	7.08	1,890
	28	do	[a] 3.23	182		29	do	5.11	1,000
Jan.	4	do	[a] 3.35	188	July	6	do	4.52	732
	11	do	[a] 3.46	186		27	do	3.83	419
	21	do	[a] 3.57	182	Aug.	3	do	3.58	343
	26	do	[a] 3.64	203		10	do	3.53	321
Feb.	2	do	[a] 3.71	185		16	L. W. Roush	3.53	316
	9	do	[a] 3.84	212		24	Karl Gilgen	3.39	268
	16	do	[a] 3.76	205		31	do	3.46	301
	24	do	[a] 3.81	209	Sept.	7	do	3.34	256
Mar.	1	do	[a] 3.86	215		14	do	3.39	278
	8	do	[a] 3.91	256		21	do	3.31	255
	15	do	[a] 5.68	948		28	do	3.23	201
	29	do	6.77	1,760					

[a] Stage-discharge relation affected by ice.

NOTE.—Karl Gilgen is an employee of Utah Power & Light Co. Comparison of measurements made in 1915 and 1916 indicate all measurements made by Gilgen prior to April, 1916. gave too great a discharge; such measurements have not been used in developing the rating curve.

Daily discharge, in second-feet, of Bear River at Harer, Idaho, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	212	234		1,470	1,970	1,140	868	378	286
2	206	234		1,420	2,060	1,120	868	359	275
3	203	234		1,330	2,110	1,240	822	344	272
4	200	237		1,330	2,020	1,240	799	329	265
5	203	237		1,370	1,970	1,420	776	329	262
6	200	234		1,370	2,020	1,510	730	329	259
7	200	234		1,280	2,060	1,470	684	329	256
8	198	243		1,240	2,210	1,470	661	344	256
9	198	246		1,240	2,350	1,420	638	329	256
10	200	243		1,140	2,400	1,560	615	321	253
11	200	243		1,190	2,400	1,650	615	321	259
12	192	228		1,330	2,450	1,700	615	321	269
13	192	234		1,470	2,350	1,740	583	321	272
14	265	250		1,600	2,300	1,700	561	321	272
15	275	265		1,700	2,250	1,830	566	321	269
16	272	280		1,650	2,160	1,790	561	321	269
17	265	295		1,560	2,060	1,650	557	318	265
18	265	310		1,560	1,880	1,700	548	303	262
19	265	278		1,600	1,790	1,790	540	292	262
20	262	253		1,600	1,700	1,880	535	286	259
21	262	246	3,210	1,600	1,650	1,970	548	286	246
22	259	253	3,610	1,560	1,600	1,930	531	286	240
23	253	253	3,210	1,470	1,560	1,830	506	286	237
24	249	249	3,030	1,420	1,560	1,700	481	278	231
25	243	269	2,860	1,370	1,560	1,420	465	272	228
26	243	292	2,600	1,420	1,470	1,330	453	262	224
27	240		2,400	1,560	1,330	1,140	433	256	221
28	237		2,060	1,650	1,240	1,080	429	253	221
29	237		1,790	1,740	1,240	1,010	437	253	221
30	237		1,700	1,880	1,240	937	413	256	224
31	237		1,560		1,190		394	289	

NOTE.—Stage-discharge relation affected by ice Nov. 27 to Mar. 20; mean discharge estimated from discharge measurements, gage height record, and weather records, as follows: Nov. 27–30, 250 second-feet; Dec. 1–31, 220 second-feet; Jan. 1–31, 190 second-feet; Feb. 1–29, 205 second-feet; Mar. 1–10, 230 second-feet; Mar. 11–15, 500 second-feet; and Mar. 16–20, 1,700 second-feet. Gage not working properly Nov. 14–17; discharge interpolated.

Monthly discharge of Bear River at Harer, Idaho, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	275	192	231	14,200
November	310	....	a 252	15,000
December	....	....	a 220	13,500
January	....	....	a 190	11,700
February	....	....	a205	11,800
March	3,610	....	a 1,330	81,800
April	1,880	1,140	1,470	87,500
May	2,450	1,190	1,880	116,000
June	1,970	937	1,510	89,800
July	868	394	588	36,200
August	378	253	306	18,800
September	286	221	253	15,100
The year	3,610	....	704	511,000

a See footnote to table of daily discharge.

BEAR RIVER AT ALEXANDER, IDAHO.

Location.—In NW. ¼ sec. 18, T. 9 S., R. 41 E., half a mile upstream from post office at Alexander, Bannock County, 6 miles above plant of Utah Power & Light Co. near Grace, 4 miles above intake of Last Chance canal, 30 miles below confluence of Bear Lake Outlet and Bear River.

Drainage area.—Not measured.

Records available.—March 27, 1911, to September 30, 1916.

Gage.—Stevens water-stage recorder on right bank installed September 15, 1914; inspected by employees of Utah Power & Light Co. March 27 to November 14, 1911, an inclined staff located on right bank 1,000 feet upstream was used; November 15, 1911, to September 14, 1914, an inclined and vertical staff at the present site. Present gage at same datum as staff gage used November 15, 1911, to September 14, 1914.

Discharge measurements.—Made from cable about 400 feet above gage.

Channel and control.—Bed composed of gravel and sand. One channel at all stages. Control permanent during 1915 and 1916.

Extremes of discharge.—Maximum stage recorded during year, 12.0 feet at 1.30 p. m. January 31, stage-discharge relation affected by ice; maximum discharge of 2,170 second-feet occurred at 9.30 p. m. March 25, at gage height 7.77 feet; minimum stage recorded, 4.96 feet at 7 a. m. November 15 (discharge 310 second-feet).

1911–1916: Maximum stage recorded, 13.8 feet at 3 p. m. December 22, 1914; maximum discharge of 3,940 second-feet occurred May 25–28, 1914, at gage height of 9.5 feet; minimum stage recorded November 15, 1915.

Ice.—Stage-discharge relation seriously affected by ice during winter.

Diversions.—Water is diverted above the station for irrigation and for storage for power development.

Regulation.—Water is diverted from Bear River to North or Mud Lake during the spring and released for power development during the summer. This water is returned to Bear River about 30 miles above the station.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve well defined between 500 and 3,500 second-feet by measurements made in 1916 and by Survey engineers in 1913 and 1915; measurements made by Karl Gilgen prior to April, 1916, believed to show too great a discharge. Operation of water-stage recorder satisfactory except for a few days in December, January, and September. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting recorder charts, except during December, January, and February, when stage-discharge relation was affected by ice. Records (except those for winter) good.

Cooperation.—Gage-height record furnished and a large number of discharge measurements made by the Utah Power & Light Co.

Discharge measurements of Bear River at Alexander, Idaho, during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Dis-charge.	Date.		Made by—	Gage height.	Dis-charge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	2	Karl Gilgen	5.32	549	Apr.	15	Karl Gilgen	6.04	922
	9	do	5.26	512		17	G. C. Baldwin	5.93	839
	16	do	5.37	587		22	Karl Gilgen	6.03	882
	23	do	5.26	504		29	do	6.09	938
	30	do	5.22	478	May	5	do	6.08	939
Nov.	6	do	5.18	460		13	do	5.78	743
	13	do	[a] 5.22	450		17	L. W. Roush	6.26	975
	20	do	5.37	541		20	do	6.70	1,330
	27	do	[a] 5.05	342		20	Karl Gilgen	6.72	1,360
Dec.	4	do	[a] 5.70	645		27	do	6.13	952
	11	do	[a] 5.35	535	June	3	do	5.99	834
	17	G. C. Baldwin	[a] 5.56	330		10	do	6.18	962
	18	Karl Gilgen	[a] 5.91	522		18	do	6.15	949
	27	do	[a] 5.98	553		24	do	7.15	1,660
Jan.	3	do		[b] 885	July	1	do	7.04	1,550
	8	do	[a] 10.16	966		8	do	6.10	908
	15	do	[a] 9.70	669		29	do	6.31	1,040
	24	do	[a] 10.40	881	Aug.	5	do	6.16	957
Feb.	5	do		[b] 761		12	do	6.12	928
	12	do	[a] 6.18	586		17	L. W. Roush	6.37	1,100
	19	do	[a] 5.91	666		19	Karl Gilgen	6.35	1,060
	26	do	5.40	556		26	do	6.13	933
Mar.	4	do	5.52	625	Sept.	2	do	6.20	983
	11	do	5.51	615		9	do	6.47	1,140
	18	do	5.78	763		16	do	6.31	1,060
	25	do	7.30	1,830		23	do	6.06	898
Apr.	1	do	6.30	1,070		30	do	5.94	812
	10	do	5.80	738					

[a] Stage-discharge relation affected by ice.
[b] Measured at Soda Springs and estimated amount of inflow added to give discharge at Alexander.

NOTE.—Karl Gilgen is an employee of Utah Power & Light Co. Comparison of measurements made in 1915 and 1916 indicate that all measurements made by Gilgen prior to April, 1916, give too great a discharge; such measurements have not been used in developing the rating curve.

Daily discharge, in second-feet, of Bear River at Alexander, Idaho, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	474	425		598	1,050	922	830	1,600	985	1,020
2	485	420		570	1,050	922	860	1,570	954	985
3	469	415		626	1,020	891	860	1,530	954	985
4	459	415		598	1,020	860	860	1,460	954	1,020
5	459	410		626	1,020	860	891	1,280	954	985
6	464	410		543	954	922	922	1,150	1,050	985
7	469	410		543	860	922	922	985	1,080	985
8	469	415		543	770	922	954	954	1,080	891
9	459	430		570	741	891	985	1,080	1,080	1,150
10	500	440		626	770	800	985	1,080	1,020	1,120
11	516	435		626	770	770	891	1,020	985	1,050
12	495	440		654	860	800	922	985	954	1,080
13	480	425		683	860	741	954	985	954	1,050
14	480	374		626	830	741	1,020	1,020	954	985
15	480	387		598	891	770	985	1,020	1,020	1,020
16	511	576		626	891	741	954	985	1,150	1,080
17	527	490		741	860	891	1,020	985	1,080	1,020
18	506	495		770	830	1,150	954	1,020	1,120	954
19	490	506		954	830	1,180	891	1,020	1,120	985
20	474	500		1,240	860	1,320	1,080	985	1,180	954
21	459	490		1,460	922	1,180	1,350	985	1,320	954
22	454	480		1,600	891	1,080	1,460	985	1,210	954
23	449	454	626	1,810	800	954	1,570	954	1,120	922
24	444	440	570	1,720	770	922	1,640	954	1,050	922
25	444	425	543	1,890	770	954	1,720	954	985	891
26	454	392	543	1,940	800	954	1,720	985	954	879
27	454		570	1,890	860	954	1,720	1,050	922	867
28	449		570	1,760	922	891	1,640	1,050	985	854
29	449		598	1,530	922	860	1,600	1,050	985	842
30	435			1,210	954	800	1,600	1,020	1,020	830
31	430			1,080		800		985	1,020	

NOTE.—Gage not working Sept. 26-29; discharge interpolated. Stage-discharge relation affected by ice Nov. 27 to Feb. 22; mean discharge estimated from discharge measurements, recorder graph, and weather records, as follows: Nov. 27-30, 450 second-feet; Dec. 1-31, 550 second-feet; Jan. 1-31, 850 second-feet; and Feb. 1-22, 670 second-feet.

Monthly discharge of Bear River at Alexander, Idaho, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	527	430	471	29,000
November			[a]443	26,400
December			[a]550	33,800
January			[a]850	52,300
February			[a]647	37,200
March	1,940	543	1,010	62,100
April	1,050	741	878	52,200
May	1,320	741	915	56,300
June	1,720	830	1,160	69,000
July	1,600	954	1,090	67,000
August	1,320	922	1,040	64,000
September	1,150	830	974	58,000
The year	1,940		838	607,000

[a] See footnote to table of daily discharge.

BEAR RIVER NEAR PRESTON, IDAHO.

LOCATION.—In sec. 9, T. 15 S., R. 39 E., at Seamon's ranch at Battle Creek highway bridge, half a mile above mouth of Battle Creek and 4½ miles northwest of Preston, Franklin County.

DRAINAGE AREA.—4,500 square miles.

RECORDS AVAILABLE.—October 11, 1889, to September 30, 1916.

GAGE.—Vertical staff attached to old bridge pile near right bank; installed July 22, 1915; read by O. M. Seamon. Inclined staff with vertical low-water section on left bank 50 feet below bridge, used December, 1904, to July 21, 1915, except from April 3, 1909, to July 6, 1914, when an inclined staff 500 feet below bridge was used. Gages used prior to December, 1904, were of vertical-staff or wire type and were attached to old Battle Creek bridge. Relation of datum of present gage to that of previous gages is not known, but datum is about 0.5 foot higher than that of gage installed in December, 1904.

DISCHARGE MEASUREMENTS.—Made from cable about 200 feet below bridge.

CHANNEL AND CONTROL.—Bed composed of sand, clay, and gravel; one channel at all stages. Control fairly permanent except during flood stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 3.29 feet at 8 a. m., March 21 (discharge, 3,020 second-feet); minimum stage recorded, 0.16 foot at 6 p. m., August 20 (discharge determined from extension of rating curve, 180 second-feet).

1889–1916: Maximum stage recorded, 5.7 feet June 12, 1907 (discharge, 6,550 second-feet); roughly approximate estimate of maximum stage, based on record at Collinston, Utah, 6.7 feet June, 1907 (discharge, 8,500 second-feet; minimum stage recorded, 0.5 foot, August 1–4 and 6–20, 1905 (discharge, 158 second-feet).

The above figures are somewhat misleading as to stage on account of differences in location and datum of various gages, but are not misleading as to dates and discharge.

ICE.—Stage-discharge relation at times seriously affected by backwater from ice.

DIVERSIONS.—Numerous ditches divert for irrigation above the station. Last Chance Canal, which diverts about 4 miles below the Alexander station, carried 270 second-feet May 25, 1911 (measured by engineer of Telluride Power Co.). West Cache Canal which heads several miles above the station carried 26 second-feet July 24, 1911, and 5 second-feet August 5, 1911. Water diverted by Utah Power & Light Co. about 6 miles below the Alexander station is used for power development and returned to the river above the station.

Regulation.—Considerable fluctuation is caused by release of water from Mud or North Lake about 150 miles above the station and by operation of power plants above the station.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read twice daily to quarter-tenths. Daily discharge determined by applying mean daily gage height to rating table. Records of daily discharge during spring and summer subject to error on account of diurnal fluctuation, but monthly means are fair. Records for remainder of year good.

Cooperation.—Gage height record furnished by Utah-Idaho Sugar Co.; one discharge measurement furnished by Utah Power & Light Co.

Record at this station shows practically the amount of water passing from Idaho into Utah and will be of value in the final adjudication of water rights.

Discharge measurements of Bear River near Preston, Idaho, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 17	Employee of Utah Power & Light Co.	0.84	557	July 9	L. W. Roush	1.50	958
18	L. W. Roush	2.61	2,160	24	do	1.31	860
June 3	do	1.11	690	Aug. 10	do	1.54	1,090
10	do	1.56	1,100	28	do	1.51	1,040
23	do	2.03	1,630	Sept. 17	do	1.65	1,160

Daily discharge, in second-feet, of Bear River near Preston, Idaho, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	752	548	490	1,320	998	679	1,790	1,570	955	1,420	830	912
2	437	548	390	580	1,130	752	1,470	1,570	912	1,420	752	679
3	464	679	370	830	1,090	679	1,470	1,570	791	1,370	871	611
4	437	464	716	1,040	998	645	1,680	1,680	871	1,320	871	966
5	548	716	679	1,470	998	548	1,570	1,680	1,040	1,270	998	1,320
6	611	318	830	791	912	912	1,570	1,680	1,130	1,230	548	1,040
7	490	318	791	519	912	791	1,570	1,130	998	1,130	548	611
8	645	296	716	645	955	830	1,470	1,470	1,090	998	679	912
9	716	490	580	912	1,090	912	1,420	1,420	1,040	390	716	971
10	390	645	645	998	830	1,180	1,470	1,230	1,040	548	955	1,030
11	611	370	645	871	679	716	2,380	1,320	871	871	830	1,090
12	679	679	548	752	1,230	912	2,260	1,320	1,130	830	998	912
13	791	437	580	580	912	998	1,790	1,320	1,040	912	1,790	830
14	548	437	414	679	830	998	679	1,270	1,040	791	645	912
15	998	548	580	830	679	1,420	1,040	1,130	998	716	1,040	912
16	328	314	752	1,040	752	955	1,570	1,130	998	830	716	1,040
17	464	548	490	1,090	830	1,090	1,470	1,470	1,040	580	955	1,090
18	437	791	1,130	1,270	679	1,320	1,570	1,680	998	490	955	1,420
19	437	791	314	1,420	679	1,470	1,570	2,020	716	791	1,090	1,040
20	519	679	390	1,040	1,040	2,130	1,570	1,790	955	716	414	1,090
21	611	611	1,090	1,370	580	2,640	1,370	1,370	1,040	716	1,130	791
22	490	548	1,180	955	998	2,260	1,470	1,090	1,320	519	1,130	716
23	490	580	871	912	679	2,380	1,370	716	1,470	752	1,270	830
24	830	611	752	1,040	830	2,130	1,370	1,090	1,470	716	830	791
25	830	437	830	1,130	830	2,640	1,370	1,130	1,570	679	871	912
26	716	548	830	716	871	2,770	1,420	791	1,570	679	1,090	1,040
27	611	830	716	548	414	2,640	1,470	871	1,680	871	1,040	1,130
28	314	679	912	580	679	1,790	1,680	716	1,570	955	791	1,090
29	328	830	998	611	791	2,380	1,680	830	1,470	1,370	912	548
30	437	437	998	490	....	2,020	1,680	830	1,470	679	752	580
31	548	....	912	611	....	1,900	....	912	....	1,040	349	....

Note.—Discharge interpolated Sept. 4, 9, and 10.

Monthly discharge of Bear River near Preston, Idaho, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	998	314	565	34,700
November	830	296	558	33,200
December	1,180	314	714	43,900
January	1,470	490	892	54,800
February	1,230	414	858	49,400
March	2,770	548	1,470	90,400
April	2,380	679	1,540	91,600
May	2,020	716	1,280	78,700
June	1,680	716	1,140	67,800
July	1,420	390	890	54,700
August	1,790	349	883	54,300
September	1,420	548	927	55,200
The year	2,770	296	977	709,000

BEAR RIVER NEAR COLLINSTON, UTAH.

Location.—In the W. ½ sec. 34, T. 13 N., R. 2 W., about a quarter of a mile below Wheelon plant of Utah Power & Light Co., at Wheelon siding, 4 miles north of Collinston, Boxelder County. Below all large tributaries except Little Malad River, which enters about 20 miles below station.

Drainage area.—6,000 square miles.

Records available.—July 1, 1889, to September 30, 1916.

Gage.—Gurley 8-day water-stage recorder on left bank about 12 feet above cable; used February 26, 1914, to September 30, 1916. Inspected by H. G. Stone. Friez recorder used November 8, 1913, to February 25, 1914. Gage installed July 1, 1889, and read to February 9, 1905, was a vertical iron bar driven into bed of stream on right bank directly opposite present gage. Gage used February 10, 1905, to November 7, 1913, was an inclined staff on right bank. Datum of gage in well to which recording gage is referred, is 0.05 foot higher than that of the vertical and slope gages.

Discharge measurements.—Made from cable.

Channel and control.—Bed composed of gravel and sand. Left bank high and not subject to overflow; right bank fairly high, but might be overflowed by exceptionally high floods. Control not well defined, but practically permanent.

Extremes of discharge.—Maximum stage recorded during the year from water-stage recorder, 5.45 feet at 10 a. m. March 23 (discharge 6,440 second-feet); minimum stage, 0.55 foot at 1 a. m. September 2 (discharge, 118 second-feet).

1889–1916: Maximum stage recorded, 7.7 feet June 7–10, 1909 (discharge, 11,600 second-feet); minimum stage, —0.55 foot August 4–12, 1905 (discharge, 10 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice. Open water rating curve applicable except for short periods.

Diversions.—Numerous diversions for irrigation and power above this station. West side canal and Hammond (East Side) canal divert water by means of a low dam about 2 miles above station and near the upper end of Bear River Canyon. Water can be used from either or both of these canals to supply the Wheelon power plant and can be siphoned across at the plant from one canal to the other. Water passing the Wheelon penstocks is used for irrigation or can be wasted into the river.

Regulation.—Flow at station regulated to some extent by operation of power plant.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined. Water-stage recorder gave satisfactory gage-height record except for three short periods in March, June, and September. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection. Records excellent.

Discharge measurements of Bear River near Collinston, Utah, during the year ending Sept. 30, 1916.

Date	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	L. C. Monson [a]	1.85	968	May 11	L. C. Monson	4.00	4,050
Jan. 13	.....do	2.14	1,240	June 13	.....do	2.82	2,240
Mar. 28	.....do	4.48	4,800	July 17	W. E. Dickinson	1.44	611
Apr. 27	W. E. Dickinson	3.88	3,890				

[a] Utah Power & Light Co. engineer.

Daily discharge, in second-feet, of Bear River near Collinston, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	752	841	1,100	1,150	1,070	1,440	3,800	4,700	1,820	1,680	444	286
2	850	878	752	1,380	1,100	1,500	3,650	4,540	1,820	1,560	520	337
3	945	787	760	1,200	1,140	1,440	3,320	4,240	2,020	1,500	398	588
4	936	860	878	1,200	1,320	1,440	3,140	4,240	1,750	1,500	485	588
5	619	955	1,020	1,500	1,320	1,500	3,320	4,240	1,750	1,440	506	528
6	814	926	1,100	1,620	1,620	2,480	3,400	4,240	2,100	1,380	542	595
7	926	1,100	1,130	1,380	1,680	2,480	3,320	4,380	2,400	1,040	535	635
8	850	832	1,200	1,140	1,680	2,170	3,140	3,940	2,320	1,150	331	627
9	869	752	1,130	1,260	1,750	2,100	2,970	4,020	2,250	1,060	499	635
10	916	850	1,140	1,620	1,880	2,640	2,880	4,240	2,170	832	513	627
11	814	1,040	1,070	1,560	1,880	3,230	2,970	4,020	2,170	580	520	619
12	787	936	1,070	1,500	1,680	3,140	3,720	3,800	2,170	565	542	743
13	1,110	1,040	1,020	1,380	1,750	3,230	4,380	3,720	2,170	588	528	869
14	1,040	1,080	975	1,200	1,820	3,460	4,240	3,400	2,020	619	558	869
15	1,020	985	1,090	1,150	1,620	3,320	3,400	3,140	1,960	675	437	787
16	1,150	1,080	1,110	1,440	1,440	3,060	3,320	2,800	1,960	659	627	760
17	965	1,020	1,120	1,500	1,380	2,970	3,650	2,560	1,820	611	611	760
18	659	796	945	1,200	1,560	3,600	3,860	2,400	1,820	450	450	769
19	823	955	1,150	1,260	1,440	4,240	3,940	2,320	1,820	367	542	778
20	832	1,100	898	1,320	1,440	4,870	4,090	1,680	1,680	588	595	787
21	888	1,140	684	1,380	1,620	5,500	3,940	2,800	1,880	572	580	796
22	907	1,130	1,040	1,380	1,560	6,000	3,800	2,480	2,240	588	535	832
23	936	1,070	1,680	1,380	1,620	6,340	3,570	2,400	2,560	385	635	814
24	860	1,040	1,620	1,440	1,680	6,000	3,400	1,960	2,480	373	709	869
25	1,040	1,090	1,150	1,440	1,750	6,000	3,490	2,320	2,320	464	684	975
26	1,080	1,180	1,200	1,440	1,750	5,170	3,570	2,480	2,400	385	635	1,040
27	1,040	1,110	1,000	1,750	1,680	4,700	3,870	2,170	2,170	343	635	1,200
28	1,040	1,150	907	1,130	1,380	4,850	4,090	2,170	2,170	450	627	1,320
29	860	1,110	1,040	1,320	1,320	4,700	4,540	2,320	1,880	499	603	1,110
30	743	1,260	1,260	1,320	....	4,380	4,850	2,020	1,680	478	572	898
31	805	....	1,200	1,200	....	4,090	....	1,750	....	325	580	....

NOTE.—No gage height record, discharge interpolated, Mar. 18–20, June 8–9, Sept. 18–19.

Monthly discharge of Bear River near Collinston, Utah, for the year ending Sept. 30, 1916

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,150	619	899	55,300
November	1,260	752	1,000	59,500
December	1,680	684	1,080	66,400
January	1,750	1,130	1,360	83,600
February	1,880	1,070	1,550	89,200
March	6,340	1,440	3,610	222,000
April	4,850	2,880	3,650	217,000
May	4,700	1,680	3,140	193,000
June	2,560	1,680	2,060	123,000
July	1,680	325	763	46,900
August	709	437	548	33,700
September	1,320	286	768	45,700
The year	6,340	286	1,700	1,240,000

SODA CREEK NEAR SODA SPRINGS, IDAHO.

Location.—In sec. 24, T. 8 S., R. 41 E., at George Schmidt's ranch, one-eighth mile below confluence of two branches of creek, about 5 miles north of Soda Springs, Bannock County.

Drainage area.—Not measured.

Records available.—March 5, 1913, to September 30, 1916.

Gage.—Vertical staff on left bank about one-fourth mile south of ranch house, installed August 1, 1913. Read by George Schmidt. Gage used March 5 to July 31, 1913, was 30 feet upstream, but had same control. Datum of old gage between 0.1 and 0.2 feet above that of present gage.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of lava rock. Control is a reef about 15 feet below the gage. Stage-discharge relation affected by growth of moss during summer. During 1915 stage-discharge relation affected by extension of a wing dam at head of small ditch, which takes water from right bank at control.

Extremes of discharge.—Maximum stage recorded during year, 4.42 feet at noon, March 24 (discharge, 95 second-feet); minimum stage recorded, 4.00 feet, March 4 to 9 (discharge, 38 second-feet).

1913–1916: Maximum stage recorded, 5.3 feet April 6, 1913 (discharge, 324 second-feet); minimum stage recorded March 4 to 9, 1916.

Ice.—Stage-discharge relation unaffected by ice.

Diversions.—Practically no water diverted above the station; a small ditch takes water just below the gage.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent on account of effect of aquatic growth; not affected by ice. Gage read to quarter-tenths daily. Daily discharge ascertained by applying daily gage height to several rating tables and by shifting control method. Records good, except for January to March, for which there was some uncertainty as to the proper rating.

Discharge measurements of Soda Creek near Soda Springs, Idaho, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Dec. 15	G. C. Baldwin	4.11	44	June 5	L. W. Roush	4.14	54
Apr. 16	do	4.14	54	Aug. 16	do	4.11	52
May 17	L. W. Roush	4.16	55				

Daily discharge, in second-feet, of Soda Creek near Soda Springs, Idaho, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	46	44	44	44	41	40	61	55	59	55	49	49
2	46	44	44	44	41	40	59	55	59	55	49	49
3	46	44	44	42	42	40	59	52	59	55	49	49
4	46	44	46	42	42	38	59	52	59	55	49	49
5	46	44	46	42	42	38	61	52	56	55	49	49
6	46	44	46	42	42	38	61	52	59	55	49	49
7	46	44	46	42	42	38	59	52	59	55	49	49
8	46	44	46	39	42	38	55	52	59	55	49	49
9	46	44	46	39	42	38	52	52	59	55	49	49
10	46	44	46	39	42	40	52	52	59	52	49	49
11	46	44	46	39	42	40	52	52	59	52	49	49
12	44	46	46	39	42	40	52	52	59	52	47	47
13	44	46	46	40	40	40	52	52	59	52	47	47
14	44	46	46	40	40	40	52	52	55	52	47	47
15	44	46	45	40	40	40	52	52	55	52	47	47
16	44	46	44	40	40	40	54	52	55	52	49	47
17	44	46	44	40	40	44	52	55	64	52	47	47
18	44	46	44	40	40	44	52	55	64	49	47	47
19	44	46	44	40	40	59	52	59	64	49	47	47
20	44	46	44	40	40	61	52	59	64	49	47	47
21	44	46	44	40	40	76	52	59	64	49	47	47
22	44	46	44	40	40	88	52	59	64	49	47	47
23	44	46	44	40	40	92	52	59	64	49	49	47
24	44	46	44	41	40	95	55	59	64	49	49	47
25	44	44	44	41	40	92	55	59	64	49	49	47
26	44	44	44	41	40	76	55	59	61	49	49	47
27	44	44	44	41	40	84	55	59	61	49	49	47
28	44	44	44	41	40	84	59	59	59	49	49	47
29	44	44	44	41	40	84	59	59	59	49	49	47
30	44	44	44	41	....	68	59	59	55	49	49	47
31	44	....	44	41	....	61	....	59	....	49	49	....

Monthly discharge of Soda Creek near Soda Springs, Idaho, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	46	44	44.7	2,750
November	46	44	44.9	2,670
December	46	44	44.7	2,750
January	44	39	40.7	2,500
February	42	40	40.8	2,350
March	95	38	56.0	3,440
April	61	52	55.1	3,280
May	59	52	55.3	3,400
June	64	55	60.0	3,570
July	55	49	51.5	3,170
August	49	47	48.4	2,980
September	49	47	47.7	2,840
The year	95	38	49.2	35,700

LOGAN RIVER ABOVE STATE DAM, NEAR LOGAN, UTAH.

Location.—In NW. ¼ NE. ¼ sec. 36, T. 12 N., R. 1 E., at Logan plant of Utah Power & Light Co., 125 feet above confluence of tailrace with river, 2½ miles above Logan, Cache County.

Drainage area.—218 square miles. Practically the same as at old station on Logan River near Logan, Utah.

Records available.—May 7, 1913, to September 30, 1916; at old station a quarter of a mile downstream, June 1, 1896, to July 17, 1903, and April 14, 1904, to December 31, 1912; flow at station plus that of tailrace comparable to that at old station.

GAGE.—Stevens continuous water-stage recorder on right bank about 100 feet west of power house. Inspected by employee of Utah Power & Light Co.

DISCHARGE MEASUREMENTS.—Made by wading at gage; high-water measurements made from footbridge at the switch rack about 1,200 feet below, and flow in tailrace deducted.

CHANNEL AND CONTROL.—Banks fairly high, clean, and not subject to overflow. Right bank is a dry rubble retaining wall. Control is concrete cut-off wall about 6 feet below the gage. Stage of zero flow, 0.45 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.6 feet at 9.30 a. m. March 21 (discharge estimated 2,000 second-feet); minimum discharge 8 second-feet December 11, stage-discharge relation affected by backwater.

1913–1916: Maximum discharge 2,000 second-feet, March 21, 1916; minimum discharge, 8 second-feet, December 11, 1915.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—The Utah Power & Light Co. diverts water above station for power and the Logan, Hyde Park & Smithfield canal diverts for irrigation. The city of Logan has a municipal power plant about 2 miles above station but water is returned to river above the two diversions noted. The city of Logan is entitled to divert for municipal supply from 4 to 10 second-feet of water, from springs in sec. 22, T. 12 N., R. 2 E., the quantity depending on flow in the river.

REGULATION.—Some diurnal fluctuation is caused at times by operation of the two power plants.

ACCURACY.—Stage-discharge relation affected during the winter by backwater from the State dam. On March 21 a portion of the artificial control was destroyed by flood and the stage-discharge relation was more or less unstable until September 1. Control was repaired September 2–5, after which the relation remained permanent. Well-defined rating curves October 1, 1915, to March 20, 1916, and September 6–30, 1916; fairly well defined March 21 to June 4 and June 19 to September 1. Operation of water-stage recorder satisfactory except March 18–21 and September 6–10. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recording gage graph, except for periods affected by backwater, and on March 21, for which it was determined by averaging the discharge obtained by applying hourly gage heights to rating table. Shifting-control method and comparison with records of station below dam and records of canals used for periods when rating curves were not directly applicable. Records good.

Discharge measurements of Logan River above State dam, near Logan, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	Lynn Crandall	0.94	19.6	Sept. 12	A. B. Purton	1.55	89.0
Jan. 13	J. J. Sanford	[a] 1.20	24.0	13	L. W. Jordan	1.54	83.7
Mar. 31	A. B. Purton	1.59	154	13	A. B. Purton	1.52	83.5
Apr. 29	Dickinson and Purton	2.91	690	17	L. W. Jordan	1.46	73.7
July 19	W. E. Dickinson	2.02	228	18	.....do	1.49	81.3
20	.....do	2.00	225	19	A. B. Purton	1.45	76.5
Sept. 8	A. B. Purton	1.58	92.1	20	L. W. Jordan	1.46	77.1
9	Purton and Jordan	1.58	87.6	22	A. B. Purton	1.40	72.6
10	A. B. Purton	1.57	90.1	23	L. W. Jordan	1.44	71.8
11	L. W. Jordan	1.56	88.3	26	A. B. Purton	1.40	68.5

[a] Stage-discharge relation affected by backwater from State dam.

Daily discharge, in second-feet, of Logan River above State dam, near Logan, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	12	19	22	30	29	161	610	604	532	139	93
2	23	12	15	20	31	30	178	604	582	527	131	90
3	22	12	10	22	32	29	181	620	615	523	124	60
4	23	13	15	24	31	29	192	684	655	523	126	75
5	22	13	12	21	31	30	200	808	776	475	116	85
6	22	13	12	23	30	30	176	802	821	461	110	85
7	21	23	12	23	28	30	168	866	776	443	104	87
8	20	27	12	22	26	30	178	802	789	400	108	87
9	20	23	10	22	26	32	194	847	795	392	114	86
10	20	20	11	22	29	39	247	828	834	372	114	89
11	20	20	8	22	30	53	341	745	814	338	110	89
12	20	24	16	23	29	67	341	672	782	320	106	85
13	18	24	10	23	27	67	294	620	764	302	97	84
14	16	19	10	25	29	64	304	566	721	295	91	100
15	16	21	11	23	28	59	337	545	727	285	88	79
16	15	28	17	23	28	59	349	524	776	268	86	78
17	24	21	18	23	28	64	377	519	776	255	86	76
18	13	21	18	29	27	80	415	561	733	246	88	76
19	13	20	22	35	26	94	390	582	732	233	86	75
20	12	20	26	32	27	150	345	626	727	227	80	73
21	12	20	21	24	28	325	322	598	721	213	78	69
22	12	20	22	29	26	225	322	655	666	202	72	70
23	12	20	18	30	29	220	341	643	608	196	70	71
24	13	18	19	30	28	200	390	610	587	188	70	71
25	13	18	21	31	28	171	499	571	567	183	90	68
26	13	18	18	30	29	154	571	540	572	178	91	66
27	13	18	22	29	30	164	690	499	572	170	90	68
28	13	17	21	28	30	189	770	480	567	165	86	60
29	13	20	16	29	31	178	721	490	557	160	86	59
30	13	22	25	30	....	164	643	550	542	153	93	59
31	12	....	30	29	....	158	....	588	....	151	90	....

Monthly discharge of Logan River above State dam, near Logan, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	24	12	16.8	1,030
November	28	12	19.2	1,140
December	30	8	16.7	1,030
January	35	20	25.7	1,580
February	32	26	28.7	1,650
March	325	29	104	6,400
April	770	161	355	21,100
May	847	480	634	39,000
June	834	542	692	41,200
July	532	151	302	18,600
August	139	70	97.4	5,990
September	100	59	76.9	4,580
The year	847	8	197	143,000

LOGAN RIVER BELOW LOGAN NORTHERN CANAL, NEAR LOGAN, UTAH.

Location.—In NW. ¼ sec. 36, T. 12 N., R. 1 E., about 500 feet below heading of Logan Northern canal, 850 feet below State dam, and 2 miles above Logan, Cache County.

Drainage area.—Not measured.

Records available.—July 26, 1915, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank about 200 feet southwest of the bridge by which State road crosses Logan Northern canal. Inspected by William Hughie.

Discharge measurements.—Made by wading or from cable 125 feet below gage.

Channel and control.—Bed composed of gravel and large boulders. Shifting. Banks not subject to overflow. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 8.35 feet at 9.45 a. m. March 21 (discharge, 1,500 second-feet); minimum stage, 3.71 feet October 21–25 (discharge, 26 second-feet).

1915–1916: Maximum and minimum same as above.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Logan, Hyde Park & Smithfield canal, and Logan Northern canal divert water above station for irrigation. The city of Logan is entitled to divert for municipal supply from 4 to 10 second-feet of water, from springs in sec. 22, T. 12 N., R. 2 E., the quantity depending on flow in the river.

Regulation.—Operation of power plants above causes some diurnal fluctuation at times during low-water periods.

Accuracy.—Stage-discharge relation disturbed by flood of March 21. Rating curves fairly well defined between 50 and 700 second-feet. Operation of water-stage recorder satisfactory except for three breaks in the record, as noted in footnote to daily discharge table. Daily discharge ascertained by applying to rating tables, the mean daily gage height determined by inspecting recorder graph except during periods for which stage-discharge relation is affected by shifting control, and for days of sudden changes of stage when it was determined by averaging the discharge obtained by applying to rating table the hourly gage height. Records good.

Discharge measurements of Logan River below Logan Northern canal, near Logan, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	E. A. Porter	4.39	77.5	Sept. 10	A. B. Purton	4.57	111
Nov. 11	Lynn Crandall	4.42	74.7	11	Jordan and Purton	4.57	108
23	R. B. West	4.45	83.8	11	L. W. Jordan	4.57	111
Dec. 5	.....do	4.30	63.6	12	.....do	4.56	104
5	.....do	4.39	62.6	13	A. B. Purton	4.54	105
5	.....do	4.23	56.7	16	L. W. Jordan	4.56	109
Jan. 13	Stoner and Sanford	4.40	76.3	17	A. B. Purton	4.56	109
Mar. 31	A. B. Purton	4.96	221	18	L. W. Jordan	4.56	107
Apr. 29	Dickinson and Purton	6.32	650	19	.....do	4.54	106
July 20	.....do	5.05	220	22	.....do	4.53	103
Sept. 8	L. W. Jordan	4.60	115	29	.....do	4.48	100
9	.....do	4.56	107				

Daily discharge, in second-feet, of Logan River below Logan Northern canal, near Logan, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	64	73	70	77	89	234	606	570	445	157	118
2	......	62	73	74	79	86	252	624	534	432	150	117
3	......	62	73	76	80	86	254	624	552	432	177	109
4	......	62	73	80	81	88	265	662	606	410	190	95
5	......	61	68	76	81	82	273	737	718	388	194	98
6	......	63	72	73	72	96	250	756	737	378	163	105
7	......	72	73	69	88	89	242	814	718	369	130	112
8	76	73	69	70	86	89	250	788	718	345	132	108
9	74	68	69	79	82	92	262	779	718	336	137	110
10	66	67	61	76	82	95	322	738	737	324	136	110
11	68	73	73	76	84	102	416	707	737	310	129	109
12	72	73	67	74	......	122	432	680	718	302	127	108
13	70	73	73	73	......	133	369	570	699	339	124	106
14	70	61	76	73	......	133	369	534	680	351	146	114
15	72	62	72	75	......	133	403	499	680	339	158	112
16	70	57	72	66	......	136	410	492	680	294	112	109
17	66	66	70	67	......	148	445	499	680	250	134	109
18	67	65	67	72	......	158	475	534	680	240	165	109
19	67	62	55	79	......	177	439	552	680	225	165	106
20	55	82	67	81	76	229	388	588	662	218	158	104
21	26	81	75	77	82	325	369	570	662	209	154	108
22	26	81	77	76	79	310	575	588	624	209	148	104
23	26	75	84	72	88	291	400	552	588	205	143	115
24	26	74	77	82	85	283	452	552	552	194	143	109
25	26	73	73	80	82	237	524	499	534	189	124	112
26	45	75	76	77	86	230	588	485	534	183	109	106
27	66	76	73	74	82	237	662	448	534	179	120	109
28	66	73	67	73	89	265	718	435	516	176	115	106
29	65	69	79	77	89	254	662	442	499	176	114	99
30	70	76	72	68	......	240	624	499	468	171	120	104
31	62	......	66	79	......	227	......	552	......	164	120	......

NOTE.—On account of breaks in recording gage record discharge was interpolated Oct. 1–7, 76 second-feet and Feb. 12–19, 80 second-feet; discharge Sept 1–6 was determined from a comparison with the total flow above the State dam.

Monthly discharge of Logan River below Logan Northern canal, near Logan, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	....	26	62.2	3,820
November	82	57	69.4	4,130
December	84	55	71.5	4,400
January	82	66	74.6	4,590
February	89	72	81.7	4,700
March	325	82	170	10,500
April	718	234	411	24,500
May	814	435	594	36,500
June	737	468	634	37,700
July	445	164	283	17,400
August	194	109	142	8,730
September	118	95	108	6,430
The year	814	26	225	164,000

UTAH POWER & LIGHT CO.'S TAILRACE NEAR LOGAN, UTAH.

LOCATION.—In NE. ¼ sec. 36, T. 12 N., R. 1 E., 100 feet below power house at plant of Utah Power & Light Co., about 2½ miles above Logan, Cache County.

RECORDS AVAILABLE.—May 7, 1913, to September 30, 1916.

GAGE.—Friez water-stage recorder on right bank just above weir; inspected by employee of Utah Power & Light Co.

DISCHARGE MEASUREMENTS.—Made from footbridge just above gage.

CHANNEL AND CONTROL.—Rectangular wooden weir, with metal crest strip, just below gage. Capacity of channel above weir not sufficient to eliminate all velocity of approach. Stage of zero flow, zero on gage.

Extremes of discharge.—Maximum stage recorded during year, 1.32 feet at 7 p. m., October 11 (discharge, 102 second-feet); no flow at times during repairs to flume or machinery.

1913-1916: Maximum stage recorded, 1.77 feet May 8, 1914 (discharge, 162 second-feet); no flow at times.

Ice.—Stage-discharge relation not affected by ice.

Regulation.—Flow at station affected by operation of power plant.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined. Water-stage recorder operated satisfactorily throughout the year. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for April 19 to July 11, for which it was determined by averaging the discharge obtained by applying hourly gage height to rating table. Records good.

Canal diverts water from right bank of Logan River in SE. ¼ of SW. ¼, sec. 29, T. 12 N., R. 2 E. Water is returned to river 150 feet below gaging station on Logan River above State dam, in the NW. ¼ of NE. ¼, sec. 36, T. 12 N., R. 1 E. Water is used for power development.

Discharge measurements of Utah Power & Light Co.'s tailrace near Logan, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	E. A. Porter	1.24	91	Mar. 31	A. B. Purton	1.18	82
Nov. 11	Lynn Crandall	1.21	85	Apr. 29	Purton and Dickinson	1.07	73
11	Eugene Schaub[a]	1.20	86	July 19	W. E. Dickinson	1.23	88
15	.....do	1.22	90	Sept. 6	Jacob and Purton	1.20	[c] 88
16	.....do	1.09	74	12	L. W. Jordan	1.22	89
19	.....do	1.27	93	19	A. B. Purton	1.17	84
Jan. 13	Stoner[b] and Sanford	1.04	70	22	.....do	1.18	86

[a] Civil and hydraulic engineer, Logan, Utah.
[b] Engineer of Utah Power & Light Co.
[c] Vertical-velocity curve method used.

Daily discharge, in second-feet, of Utah Power & Light Co.'s tailrace near Logan, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	91	92	76	66	65	77	85	53	30	32	92	87
2	92	91	80	72	68	77	84	54	30	32	92	87
3	92	89	85	74	70	74	84	58	29	32	92	87
4	92	89	80	76	72	74	84	54	34	12	93	87
5	92	88	83	75	68	78	84	53	32	31	93	87
6	92	89	83	70	69	79	85	54	32	29	92	88
7	92	92	83	67	77	76	85	54	32	32	91	88
8	92	92	83	70	76	77	85	53	31	52	89	88
9	92	91	85	73	73	76	85	53	31	53	85	88
10	92	91	84	73	72	77	85	53	31	63	85	89
11	94	99	87	73	72	78	84	54	35	86	84	85
12	94	97	79	72	69	79	85	54	20	88	85	89
13	97	87	85	72	68	82	85	54	20	91	86	86
14	97	82	85	70	73	86	85	54	19	91	87	68
15	99	91	84	72	73	89	85	29	19	91	87	82
16	99	66	78	60	74	91	84	29	19	91	87	82
17	72	85	77	61	74	94	83	29	19	91	87	82
18	94	84	73	66	73	95	85	39	19	92	86	83
19	94	87	61	70	75	99	66	29	31	91	84	84
20	93	87	68	70	72	98	51	29	32	88	88	84
21	93	85	74	66	74	94	51	29	32	92	87	85
22	92	87	76	65	75	89	51	29	31	92	87	85
23	92	85	82	68	75	70	57	29	31	91	87	85
24	92	87	79	69	74	86	60	32	31	91	86	86
25	93	84	76	70	74	85	58	29	31	91	86	86
26	93	87	77	69	75	85	55	29	35	91	86	87
27	92	85	68	62	76	85	55	29	36	91	86	89
28	92	67	64	60	75	85	54	29	26	92	86	89
29	92	77	79	63	76	84	54	29	31	92	86	91
30	93	82	65	61	......	85	54	29	31	92	88	91
31	91	......	55	65	......	85	......	29	......	91	87	......

Monthly discharge of Utah Power & Light Co.'s tailrace near Logan, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	99	72	92.5	5,690
November	99	66	86.5	5,150
December	87	55	77.2	4,750
January	76	60	68.4	4,210
February	77	65	72.7	4,180
March	99	70	83.5	5,130
April	85	51	72.9	4,340
May	58	29	40.7	2,500
June	36	19	28.7	1,710
July	92	12	73.3	4,510
August	93	84	87.6	5,390
September	91	68	85.8	5,110
The year	99	12	72.5	52,700

LOGAN, HYDE PARK & SMITHFIELD CANAL NEAR LOGAN, UTAH.

Location.—In NW. ¼ NE. ¼ sec. 31, T. 12 N., R. 2 E., at concrete rating flume about half a mile below head of canal, 1 mile below city power plant, 1 mile above plant of Utah Power & Light Co., and 3½ miles from Logan, Cache County.

Records available.—Fragmentary 1904–1912. Fairly continuous April 22, 1912, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank near lower end of rating flume; installed June 6, 1913. Records April 22, 1912, to March 31, 1913, obtained from vertical staff gage at point about 1½ miles below present gage; two wasteways between the two points. Prior to April 22, 1912, gages were maintained at various points. Gage inspected by G. B. Folkman.

Discharge measurements.—Made by wading or from a foot plank at the flume.

Channel and control.—Rectangular concrete rating flume. Stage of zero flow after control board was installed in April, 1915, 0.35 foot.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 2.39 feet at 12 p. m. July 20 (discharge, 111 second-feet); minimum stage recorded, 0.53 foot, April 30 (discharge 2.6 second-feet); minimum discharge probably zero (while canal is being cleaned).

1912–1916: Maximum stage recorded, 2.46 feet July 24, 1914 (discharge, 114 second-feet).

Winter flow.—Recording gage usually removed during winter. A small flow of water is maintained for domestic use.

Diversions.—None above the gage.

Regulation.—Flow regulated by headgates at diversion works.

Accuracy.—Stage-discharge relation permanent; record discontinued during winter Rating curve well defined below 120 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting recorder graph. Records excellent.

Canal diverts water from Logan River in the NE. ¼ NE. ¼ sec. 31, T. 12 N., R. 2 E., for irrigation and domestic use in the territory north of Logan. The water is not returned to the river.

Discharge measurements of Logan, Hyde Park & Smithfield canal near Logan, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	E. A. Porter	0.93	22.9	Apr. 29	Purton and Dickinson	0.55	3.1
Nov. 11	Lynn Crandall	.71	11.3	July 19	W. E. Dickinson	2.35	110

Daily discharge, in second-feet, of Logan, Hyde Park & Smithfield canal near Logan, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	21	14	7.5		8.1	76	102	106	49
2	25	21	14	7.5		23	80	102	108	49
3	25	20	14	7.5		28	80	101	108	80
4	26	20	14	7.5		49	83	101	107	62
5	25	20	14	7.5		51	85	100	107	48
6	24	20	14	7.5		65	86	99	106	48
7	24	11	14	8.7		80	88	99	106	44
8	23	3.7	14	8.7		97	85	106	99	40
9	23	6.9	14	8.7		100	92	106	87	40
10	23	12	14	8.7		99	95	106	83	40
11	23	12	14	8.7		98	93	106	82	40
12	23	12	14	8.7		100	92	105	81	40
13	22	12	14	8.7		102	94	104	84	40
14	22	12	14	8.7		99	97	106	87	40
15	22	12	14	8.7		92	98	106	87	40
16	21	12	14	8.7		92	99	106	86	40
17	25	15	14	8.7		91	99	106	83	40
18	24	15	14	9.3		92	97	109	76	40
19	23	15	10	9.3		88	94	108	82	40
20	23	15	5.8	9.3		72	93	108	88	40
21	23	15	5.8	9.3		72	93	108	89	40
22	22	15	5.8	8.7		73	96	107	92	40
23	22	15	7.5	8.7		85	99	106	92	39
24	22	15	7.5	8.7	6.4	85	96	106	78	39
25	22	15	7.5	8.7	6.4	72	94	106	61	38
26	22	14	7.5	8.7	7.5	71	93	105	61	38
27	22	14	7.5	8.7	8.7	69	93	104	61	38
28	22	14	7.5	8.7	6.4	69	93	104	61	38
29	22	14	7.5	8,7	3.4	69	94	104	58	38
30	22	15	7.5	8.7	2.6	70	102	103	49	38
31	21		7.5	8.7		70		102	49	

NOTE.—No record kept during winter; probably a small flow maintained for domestic use.

Monthly discharge of Logan, Hyde Park & Smithfield canal near Logan, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	26	21	23.0	1,410
November	21	3.7	14.5	863
December	14	5.8	11.2	689
January	9.3	7.5	8.55	526
April 24–30	8.7	2.6	5.91	82.1
May	102	8.1	75.2	4,620
June	102	76	92.0	5,470
July	109	99	105	6,460
August	108	49	84.0	5,160
September	80	38	42.9	2,560

NOTE.—No records kept during winter.

LOGAN NORTHERN CANAL NEAR LOGAN, UTAH.

Location.—In NW. ¼, sec. 36, T. 12 N., R. 1 E., at upper end of timber-lined section about 800 feet below head of canal and 2 miles above Logan, Cache County.

Records available.—June 6, 1913, to September 30, 1914; May 13, 1915, to October 2, 1916. Station discontinued.

Gage.—Stevens continuous water-stage recorder on right bank immediately above lined section of canal. Inspected by employee of Logan Northern Canal Co.

Discharge measurements.—Made by wading or from footplank.

Channel and control.—Bed at gage is of earth and gravel; immediately below is a timber-lined rectangular section which contracts the width very slightly. A low control board has been installed at upper end of this section making stage of zero flow 0.45 foot.

Extremes of discharge.—Maximum stage recorded during year, 2.52 feet, May 22 (discharge, 91 second-feet); canal dry part of year.

1913–1916: Maximum stage recorded, 2.58 feet, July 15, 1913 (discharge, 103 second-feet); canal dry most of nonirrigation season.

Winter flow.—No record kept during winter; canal is usually dry.

Diversions.—Above all diversions.

Regulation.—Flow regulated by head gates at point of diversion.

Accuracy.—Stage-discharge relation permanent. Rating curve fairly well defined between 20 and 90 second-feet. Operation of water-stage recorder satisfactory except for breaks in record as shown in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for days when there was considerable fluctuation for which the mean of hourly discharge was used. Records good.

Canal heads in right bank of Logan River in the SW. ¼ NW. ¼ sec. 36, about 350 feet below the State dam. The water is used primarily for irrigation and is not returned directly to the river.

Records of daily and monthly discharge for October, November, and December, 1915, published in Water-Supply Paper 410, should be disregarded.

Discharge measurements of Logan Northern canal near Logan, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	E. A. Porter	0.94	22.6	Sept. 11	L. W. Jordan	1.62	46.2
Nov. 11	Lynn Crandall	0.99	23.1	12	A. B. Purton	1.60	47.0
Apr. 29	A. B. Purton	1.06	27.8	13	L. W. Jordan	1.61	46.7
July 20	W. E. Dickinson	2.39	84.0	16	do	1.59	46.0
Sept. 7	L. W. Jordan	1.62	46.7	17	A. B. Purton	1.56	44.8
8	do	1.66	48.9	19	do	1.58	44.6
9	A. B. Purton	1.62	47.5	22	L. W. Jordan	1.58	43.7
10	do	1.62	46.9				

Daily discharge, in second feet, of Logan Northern canal near Logan, Utah, for the period Oct. 1, 1915 to Oct. 2, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	20	25	6	2	......	10	54	79	67	62	44
2	20	25	6	2	......	......	60	80	67	63	26
3	20	25	6	2	......	......	62	80	16	36	......
4	20	24	6	1	......	......	64	79	......	60	......
5	20	24	6	......	......	......	68	78	......	67	......
6	20	24	6	......	......	......	67	78	31	60	......
7	20	26	6	......	......	......	67	80	62	49	......
8	20	30	6	......	......	......	74	86	65	46	......
9	20	30	6	......	......	29	82	87	66	46	......
10	20	30	12	......	......	52	69	87	66	46	......
11	20	26	4	......	......	39	68	85	67	46	......
12	20	23	4	......	......	22	68	82	68	45	......
13	20	23	3	......	8	76	73	22	67	45	......
14	20	20	3	......	14	76	78	......	25	46	......
15	20	28	3	......	14	74	78	......	17	46	......
16	20	32	3	1	14	76	78	42	62	44	......
17	20	24	3	2	14	80	78	82	34	43	......
18	20	24	3	2	14	84	80	83	......	44	......
19	20	22	2	2	......	85	80	84	......	44	......
20	28	6	2	2	......	88	80	84	......	44	......
21	56	5	1	2	......	86	66	84	......	43	......
22	56	4	......	2	......	90	54	75	2	44	......
23	56	4	......	2	......	81	53	71	8	44	......
24	56	11	......	2	......	64	52	78	3	43	......
25	56	12	......	......	......	63	56	77	41	43	......
26	41	8	......	......	......	52	66	77	69	43	......
27	22	5	......	......	......	45	66	77	54	43	......
28	22	5	......	......	......	44	66	74	61	43	......
29	22	5	......	......	26	44	68	65	62	43	......
30	18	5	1	......	26	46	75	66	62	43	......
31	25	......	2	......	......	47	......	68	62	......	......

NOTE.—Mean discharge Apr. 19–28 estimated 15 second-feet, as recording gage clock stopped. No flow Dec. 22–29, Jan. 5–15, Jan. 25 to Apr. 12, May 2–8, July 14–15, Aug. 4–5, and Aug. 18–21.

Monthly discharge of Logan Northern canal near Logan, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	56	18	27.0	1,660
November	32	4	18.5	1,100
December	12	0	3.23	199
January	2	0	.774	47.6
February	0	0	0	0
March	0	0	0	0
April	....	0	9.33	555
May	90	0	46.9	2,880
June	82	52	68.3	4,060
July	87	0	70.6	4,340
August	69	0	38.7	2,380
September	67	36	47.1	2,800
The year	90	0	27.6	20,000

BLACKSMITH FORK ABOVE UTAH POWER & LIGHT CO.'S DAM, NEAR HYRUM, UTAH.

Location.—In NE. ¼ sec. 8, T. 10 N., R. 2 E., 1 mile above diversion dam, 3½ miles above power plant of Utah Power & Light Co., 6 miles east of Hyrum, Cache County.

Drainage area.—About 260 square miles (measured on topographic maps and map of Cache National Forest).

Records available.—July 19, 1900, to December 31, 1902; November 28, 1913, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank 500 feet above wagon bridge and nearly a mile above dam; installed November 28, 1913. Gage at old tollgate in mouth of canyon about 3½ miles downstream was used July 19, 1900, to December 31, 1902. Flow approximately the same at both points. Gage inspected by employee of Utah Power & Light Co.

Discharge measurements.—Made by wading about three-eighths mile above gage, or from cable a quarter of a mile above gage. Conditions at wading section good; at cable poor, especially at high stages.

Channel and control.—Bed rough but fairly permanent; one channel at all stages.

Extremes of discharge.—1913–1916: Maximum stage recorded, 4.65 feet at 4 a. m. April 28, 1916 (discharge, 1,020 second feet); minimum stage, 0.85 foot at 6 a. m. February 6, 1916 (discharge, estimated from an extension of rating curve, 22 second-feet).

Ice.—Stage-discharge relation affected by ice for short periods.

Diversions.—Above all important diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice December 19, 20, and 22–31, January 1, 2, 17, 18, 21, 22, 28, and 29. Rating curve well defined between 60 and 300 second-feet and fairly well above that. Operation of water-stage recorder satisfactory except that inlet pipe is believed to have been partly clogged from July 19 to September 30. Daily discharge ascertained by applying mean daily gage height to rating table except for ice-affected periods. for which discharge was etimated, and July 19 to September 30, when discharge was obtained from comparison with record of flow at stations on Hyrum canal and Blacksmith Fork below Hyrum canal. See footnote to daily discharge table. Records fair.

Discharge measurements of Blacksmith Fork above Utah Power & Light Co.'s dam, near Hyrum, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	E. A. Porter	1.37	87	Apr. 28	Purton and Dickinson.	4.14	735
Jan. 12	Stoner[a] and Sanford	1.28	66	May 10	L. C. Monson	3.27	513
Mar. 27	L. C. Monson[a]	2.17	213	June 12	do	2.19	220
30	A. B. Purton	2.15	206	July 18	W. E. Dickinson	1.91	153

[a] Utah Power & Light Co. engineer.

Note.—Gage heights corrected to true datum.

Daily discharge, in second-feet, of Blacksmith Fork above Utah Power & Light Co.'s dam, near Hyrum, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	81	81	77	66	66	83	214	528	236	161		
2	81	81	76	68	67	83	250	513	230	161		
3	81	81	76	70	69	76	250	498	221	159		
4	81	81	74	70	67	77	261	528	223	159		
5	81	81	74	70	66	87	266	606	226	159		
6	81	81	73	67	67	86	240	606	226	157		
7	81	83	74	67	77	83	226	622	221	157		
8	81	81	74	67	76	81	236	560	214	157		
9	81	81	74	73	73	86	266	544	206	153		
10	81	83	74	70	71	104	328	498	206	153		
11	81	81	74	69	70	118	452	437	206	151		
12	81	80	74	67	69	132	498	392	199	148		
13	81	78	74	69	67	148	407	348	195	148		110
14	81	78	74	69	70	140	392	320	190	148		116
15	81	80	74	70	69	134	467	301	188	151		
16	81	80	74	70	69	138	513	287	186	151		
17	81	78	74	65	70	161	560	282	181	151		
18	81	78	73	65	70	181	622	279	179	151		
19	81	78	70	71	71	221	513	282	179			
20	81	78	70	70	76	269	407	295	181		122	
21	81	80	73	65	78	467	378	284	186			
22	81	78		65	80	317	392	284	186			
23	81	80		71	80	312	437	276	179			
24	81	78		71	81	274	544	271	174			
25	80	80		71	83	228	638	258	172			
26	81	78		70	86	214	750	246	170			
27	81	78		70	87	228	800	238	170			
28	80	84		69	86	261	900	230	166			
29	80	81		68	84	236	800	228	166			
30	81	80		66		211	622	233	163			
31	81			66		204		238				

NOTE.—Mean discharge estimated on account of ice, Dec. 22–31, 65 second-feet. Inlet pipe partly clogged July 19 to Sept. 30, and mean discharge estimated as follows: July 19–25, 150 second-feet; July 26–31, 148 second-feet; Aug. 1–9, 142 second-feet; Aug. 10–14, 135 second-feet; Aug. 15–19, 130 second-feet; Aug .21–27, 112 second-feet; Aug. 28 to Sept. 12 and Sept. 15–30, 125 second-feet.

Monthly discharge of Blacksmith Fork above Utah Power & Light Co.'s dam, near Hyrum, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	81	80	80.9	4,970
November	84	78	80.0	4,760
December	77		71.0	4,370
January	73	65	68.5	4,210
February	87	66	74.0	4,260
March	467	77	176	10,800
April	900	214	454	27,000
May	622	223	371	22,800
June	236	163	194	11,500
July	161		152	9,350
August			129	7,930
September			124	7,380
The year	900		165	119,000

BLACKSMITH FORK AT UTAH POWER & LIGHT CO.'S PLANT NEAR HYRUM, UTAH.

LOCATION.—In sec. 11, T. 10 N., R. 1 E., immediately above wagon bridge, 300 feet above confluence of Utah Power & Light Co.'s tailrace with main stream, 2¼ miles east of Hyrum, Cache County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 15, 1914, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank; inspected by Joseph Appleyard.

DISCHARGE MEASUREMENTS.—Made by wading or from cable at gage.

CHANNEL AND CONTROL.—Bed composed of gravel overgrown with aquatic plants. Concrete cut-off wall about 10 feet below gage forms control.

Extremes of discharge.—1914–1916: Maximum stage, from water-stage recorder, 6.85 feet at 7 a. m., April 28, 1916 (discharge, 852 second-feet); minimum stage, 3.77 feet October 1 and 2, 1915 (discharge, 8 second-feet).

Ice.—Stage-discharge relation not affected by ice, as low-water flow is maintained by springs a short distance above gage.

Diversions.—Water diverted for power development by Utah Power & Light Co. 2½ miles above station is returned to river 300 feet below it. During periods of low water entire flow is diverted and records obtained at gage represent inflow from springs between diversion dam and gage. The Hyrum power canal diverts 300 feet below gage at the mouth of the Utah Power & Light Co. tailrace. Station is above all diversions for irrigation.

Regulation.—See diversions.

Accuracy.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined except for extreme low stages. Operation of water-stage recorder satisfactory except for short breaks in record as shown in footnote to table of daily discharge. Daily discharge determined by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records excellent for high stages and good for low stages.

Discharge measurements of Blacksmith Fork at Utah Power & Light Co.'s plant near Hyrum, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	E. A. Porter	3.79	[a] 9.5	Apr. 28	W. E. Dickinson	6.42	673
Jan. 12	Stoner and Sanford	3.82	[b] 8.1	July 18	do	4.08	31.3
Mar. 30	A. B. Purton	4.75	138				

[a] Estimated, 200 feet below station.

[b] Measured 75 feet above station.

Daily discharge, in second-feet, of Blacksmith Fork at Utah Power & Light Co.'s plant near Hyrum, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8	10	10	10	15	16	132	381	143	42	22	10
2	8	10	10	10	15	15	171	348	136	42	22	10
3	8	10	10	10	15	15	171	345	126	38	21	11
4	8	10	10	10	15	14	180	378	122	38	21	11
5	8	10	10	10	15	14	187	412	122	38	26	11
6	8	10	10	10	15	14	160	416	122	37	24	11
7	8	10	10	11	15	14	145	445	118	36	21	11
8	8	10	9	11	15	14	153	381	114	35	20	10
9	8	10	9	11	15	14	180	367	112	34	20	10
10	9	10	9	11	15	15	226	332	108	33	20	10
11	9	10	9	11	15	16	348	304	102	33	18	10
12	9	10	9	10	15	29	398	261	95	33	18	10
13	9	10	9	10	15	53	292	223	91	33	17	14
14	9	10	9	10	15	58	272	199	82	33	16	13
15	9	10	9	10	15	56	332	182	80	31	15	11
16	9	10	9	10	15	62	371	169	75	30	14	11
17	9	10	10	10	16	84	402	162	72	30	13	11
18	10	10	10	10	16	108	460	156	66	31	13	10
19	10	10	10	10	16	143	381	164	63	28	13	10
20	10	10	10	10	16	176	298	162	64	28	13	10
21	10	10	10	11	16	402	281	160	69	27	21	10
22	10	10	10	11	16	307	304	167	69	23	14	11
23	10	10	10	11	16	286	332	162	63	25	13	11
24	10	10	10	14	16	216	430	164	58	26	13	11
25	10	10	10	14	16	162	518	158	56	25	13	11
26	10	10	10	14	17	145	626	149	56	26	13	11
27	10	10	10	15	17	153	698	145	53	24	11	11
28	10	10	10	15	17	185	754	136	49	25	11	11
29	10	10	10	15	17	167	670	132	60	25	11	11
30	10	10	10	15	......	141	452	138	48	23	10	11
31	10	......	10	15	......	132	......	145	......	23	10	......

Note.—Daily discharge interpolated when water-stage recorder was not operating satisfactorily Dec. 4–11, 21–25, Feb. 8–12, and Aug. 14–16.

Monthly discharge of Blacksmith Fork at Utah Power & Light Co.'s plant near Hyrum, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	10	8	9.16	563
November	10	10	10.0	595
December	10	9	9.71	597
January	15	10	11.5	707
February	17	15	15.6	897
March	402	14	104	6,400
April	754	132	344	20.500
May	445	132	240	14,800
June	143	48	86.5	5,150
July	42	23	30.8	1,890
August	26	10	16.4	1,010
September	14	10	10.8	643
The year	754	8	73.9	53,800

BLACKSMITH FORK BELOW UTAH POWER & LIGHT CO.'S PLANT NEAR HYRUM, UTAH.

Location.—In sec. 2, T. 10 N., R. 2 E., 600 or 700 feet below heading of Hyrum power canal and mouth of Utah Power & Light Co.'s tailrace, and about 2½ miles east of Hyrum, Cache County.

Drainage area.—Not measured.

Records available.—July 19, 1900, to December 31, 1902; May 16, 1904, to December 31, 1910; April 15, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank, installed April 15, 1915. Gage used 1904–1910 was vertical staff about 300 feet above present site and at different datum. Gage inspected by Joseph Appleyard.

Discharge measurements.—Made by wading at various sections or from cable about 100 feet below gage. Conditions for measuring poor and there are many springs along this section of the river.

Channel and control.—Bed composed of gravel and boulders; steep. Banks low and covered with willows, but probably not overflowed except during extraordinary floods. Concrete wall about 10 feet below gage acts as control. Stage of zero flow 4.4 feet until control wall was undermined during the spring, altering the stage-discharge relation.

Extremes of discharge.—Maximum stage recorded during year, 7.58 feet at 7 a. m. April 28 (discharge, 921 second-feet); minimum stage, 4.49 feet October 15 and 16 (discharge, 2 second-feet).

1904–1910 and 1914–1916: Maximum stage recorded, 6.8 feet April 16, 1907 (discharge, 1,810 second-feet); minimum stage, 4.49 feet October 15 and 16, 1915 (discharge 2 second-feet). New datum in 1915. See "Gage."

Ice.—Stage-discharge relation not usually affected by ice, on account of springs in the vicinity.

Diversions.—Water diverted above station by Hyrum power canal is returned to river about a quarter of a mile downstream. The Utah Power & Light Co. diverts about 2½ miles upstream, but the tailrace of this plant enters just above head of Hyrum canal.

Regulation.—Flow at gage affected by operation of the two plants.

Accuracy.—Stage-discharge relation not permanent, as cut-off wall forming control was undermined. Two rating curves, fairly well defined except for stages below 20 second-feet, used, respectively, October 1 to April 27, and April 28 to September 30. Stage of zero flow definitely fixed until the high water in April. Operation of water-stage recorder good. Daily discharge determined by applying to rating tables mean daily gage height obtained by inspecting recording gage graph. Records good.

Discharge measurements of Blacksmith Fork below Utah Power & Light Co.'s plant near Hyrum, Utah, during the year ended Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	E. A. Porter	4.54	2.8	Apr. 28	Dickinson and Purton	7.38	798
Jan. 12	Stoner and Sanford	4.71	12.6	July 18	W. E. Dickinson	5.31	88
Mar. 30	A. B. Purton	6.04	206				

Daily discharge, in second-feet, of Blacksmith Fork below Utah Power & Light Co.'s plant near Hyrum, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	3	3	5	3	73	212	563	252	150	79	45
2	10	3	3	6	3	71	253	538	252	150	79	45
3	10	3	3	6	10	71	253	538	238	150	79	45
4	10	3	3	6	43	73	253	563	238	150	80	45
5	10	3	3	5	32	83	268	614	238	150	83	45
6	10	3	4	4	34	84	239	614	238	150	82	44
7	10	3	4	4	39	81	225	640	226	150	80	45
8	10	4	4	4	39	80	225	588	226	150	75	44
9	5	4	4	10	53	83	268	588	213	150	70	43
10	2	4	4	14	64	86	336	538	213	141	69	43
11	2	4	4	13	64	86	481	490	213	141	68	43
12	2	3	4	12	61	92	554	445	202	141	68	43
13	2	3	5	13	60	115	458	404	213	141	69	34
14	2	3	5	12	62	124	436	365	202	141	67	36
15	2	3	4	14	62	115	529	347	202	116	66	40
16	2	3	4	11	62	124	554	329	202	90	66	43
17	2	3	4	5	62	143	607	312	190	88	66	44
18	2	3	4	8	65	164	634	312	180	90	66	43
19	2	3	3	14	65	199	529	312	190	87	65	42
20	2	3	3	13	67	268	415	312	190	87	60	41
21	2	4	3	10	67	481	374	312	190	86	51	41
22	3	4	3	10	70	355	394	312	190	83	49	40
23	4	4	3	13	70	355	436	296	190	83	49	42
24	4	4	3	6	70	301	529	296	180	83	48	40
25	4	4	3	3	70	239	634	281	180	83	48	40
26	4	4	3	3	76	212	748	266	169	83	48	40
27	4	4	3	3	77	225	778	252	169	82	50	39
28	4	3	4	3	76	268	840	238	160	82	45	39
29	4	5	4	3	73	239	810	238	160	82	45	38
30	3	4	4	3	....	225	640	252	160	81	45	38
31	3	....	4	3	....	199	....	252	....	80	45	....

Monthly discharge of Blacksmith Fork below Utah Power & Light Co.'s plant near Hyrum, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	10	2	4.71	290
November	5	3	3.47	206
December	5	3	3.61	222
January	14	3	7.71	474
February	77	3	55.1	3,170
March	481	71	171	10,500
April	840	212	464	27,600
May	640	238	400	24,600
June	252	160	202	12,000
July	150	80	114	7,010
August	83	45	63.2	3,890
September	45	34	41.7	2,480
The year	840	2	127	92,400

HYRUM CITY POWER CANAL NEAR HYRUM, UTAH.

Location.—In sec. 2, T. 10 N., R. 1 E., 300 feet below head of canal, which diverts immediately below confluence of Utah Power & Light Co.'s tailrace with river, 2½ miles east of Hyrum, Cache County.

Records available.—1904 to 1910 and April 15, 1914, to September 30, 1916. Records from 1904 to 1910 were published under head "Blacksmith Fork (or Hyrum) power-plant race near Hyrum, Utah."

Gage.—Stevens continuous water-stage recorder on right bank immediately below footbridge; inspected by Joseph Appleyard. Gage used 1904–1910 was vertical staff at about same site but different datum.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Bed composed of earth and gravel. Right bank covered with willows. Control not clearly defined.

Extremes of discharge.—Maximum stage recorded during year, 6.17 feet September 30 (discharge, 96 second-feet); canal dry at times during year.

1904–1910, 1914–1916: Maximum stage recorded, 6.5 feet April 3, 1915 (discharge, 128 second-feet); canal dry at times during 1916.

Ice.—Stage-discharge relation not seriously affected by ice; open water rating curve applicable throughout the winter.

Diversions.—None.

Regulation.—Flow regulated by gates at head of canal.

Accuracy.—Stage-discharge relation permanent; affected May 8 to July 14 by check dam used for irrigation. Rating curve well defined for normal flow of canal but poorly defined for extremely low stages. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph or by averaging hourly discharge for days when stage fluctuated considerably. Records for high stages good.

Canal diverts water from left side of Blacksmith Fork in sec. 2, T. 10 N., R. 1 E., immediately below tailrace of Utah Power & Light Co. Water used for power development at Hyrum city power plant and returned to the river.

Discharge measurements of Hyrum city power canal near Hyrum, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	E. A. Porter	5.96	80	Apr. 28	A. B. Purton	4.42	7.6
Dec. 1	Stoner and Sanford	5.61	53	July 18	W. E. Dickinson	5.94	79
Mar. 30	A. B. Purton	3.93	3.8				

Daily discharge, in second-feet, of Hyrum City power canal near Hyrum, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.
1	68	76	64	51	64	......	3	8	......	76	94
2	68	76	66	77	68	......	5	8	......	75	92
3	68	76	69	66	60	......	6	10	......	75	92
4	71	76	69	72	20	......	6	10	......	74	90
5	70	77	69	67	31	......	6	10	......	74	92
6	70	78	70	65	31	......	6	10	......	73	90
7	70	79	70	61	31	......	6	10	......	71	92
8	73	78	70	69	32	......	6	......	......	77	90
9	76	77	69	64	12	......	6	......	......	84	90
10	80	83	69	54	......	......	6	......	......	81	92
11	80	76	68	53	......	......	8	......	......	78	93
12	80	77	71	52	......	......	......	......	......	76	94
13	80	76	69	54	......	......	......	......	......	75	86
14	80	72	69	55	......	......	......	......	......	72	90
15	80	76	69	56	......	......	......	......	40	74	93
16	80	78	66	56	......	......	......	......	80	76	94
17	80	74	71	49	......	......	......	......	77	75	94
18	80	74	63	50	......	......	......	......	76	74	94
19	80	74	58	54	......	......	......	......	78	76	93
20	79	75	64	55	......	......	......	......	80	76	91
21	77	76	68	53	......	......	......	......	80	76	92
22	79	77	69	54	......	......	......	......	80	79	92
23	80	74	72	56	......	......	......	......	79	76	93
24	80	76	69	66	......	......	1	......	79	76	93
25	79	74	68	70	......	......	6	......	78	77	93
26	77	74	70	70	......	......	8	......	78	76	93
27	78	76	55	63	......	......	8	......	78	76	93
28	78	73	63	65	......	1	8	......	78	92	93
29	76	65	68	63	......	2	8	......	78	92	94
30	76	65	59	65	......	3	8	......	78	94	96
31	75	......	42	65	......	3	......	......	76	93	......

NOTE.—Discharge interpolated Oct. 8 and 14. No flow Feb. 10 to Mar. 27 and April 12 to 23. May 8 to July 14, a check dam across canal for irrigation, "a small irrigating stream in the canal for part of the time."

Monthly discharge of Hyrum City power canal near Hyrum, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	80	68	76.4	4,700
November	83	65	75.3	4,480
December	72	42	66.3	4,080
January	77	49	60.3	3,710
February	68	....	12.0	690
March	3	....	.290	18
April	8	....	3.70	220
May 1-7	10	8	9.43	131
July 15-31	80	40	76.1	2,560
August	94	71	78.0	4,800
September	96	86	92.3	5,490

WEST SIDE CANAL NEAR COLLINSTON, UTAH.

Location.—In NW. ¼ sec. 34, T. 13 N., R. 2 W., at Wheelon siding on Oregon Short Line Railroad, about 600 feet below penstock of Utah Power & Light Co., Wheelon plant, 1,000 feet northwest of gaging station on Bear River and 4 miles north of Collinston, Boxelder County.

Records available.—June 1, 1912, to September 30, 1916.

Gage.—Friez water-stage recorder on left bank installed May 22, 1914, at same site and datum as inclined gage used prior to that time. Gage inspected by H. G. Stone.

Discharge measurements.—Made from footbridge at gage or by wading.

Channel and control.—Bed composed of earth and gravel. Banks steep and clean. Control not well defined; stage-discharge relation probably affected by vegetal growth and slight silt deposit.

Extremes of discharge.—Maximum stage recorded during year, 7.4 feet August 30 (discharge, 532 second-feet); canal dry at various times.

1912–1916: Maximum stage recorded, 7.86 feet July 1, 1912 (discharge, 563 second-feet); canal dry at various times in 1913, 1915, and 1916.

Ice.—Stage-discharge relation seriously affected at times by ice.

Diversions.—Water is taken out of canal, about 600 feet above gage, for the power plant, and, if necessary, water can also be siphoned across the river to Hammond ditch.

Regulation.—Flow can be regulated at headgates and also at fore bay of power plant.

Accuracy.—Stage-discharge relation not permanent; changed by cleaning of canal and later by silting and vegetal growth. Rating curves fairly well defined between 0 and 500 second-feet. Water-stage recorder operated satisfactorily except for short periods when staff gage readings were secured. Recorder not in operation from December 23 to May 10. Daily discharge determined by applying mean daily gage height to rating tables. Records good except during winter, for which they are poor.

Cooperation.—Record of mean daily gage height and part of discharge measurements furnished by Utah Power & Light Co.

Canal diverts water from west side of Bear River in the SW. ¼ sec. 23, T. 13 N., R. 2 W., by means of a low diversion dam. Part of the water is used through the Wheelon plant of the Utah Power & Light Co. about 1½ miles below; the rest of that which passes the gaging station is used for irrigation on west side of river. When cleaning or repairing Hammond canal in the canyon water can be siphoned across the river at the power plant from West Side canal.

Discharge measurements of West Side canal near Collinston, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 13	L. C. Monson[a]	2.26	36.3	June 13	L. C. Monson	7.00	478
May 11	.....do	3.95	151	July 17	W. E. Dickinson	7.20	506

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[a] Engineer, Utah Power & Light Co.

Daily discharge, in second-feet, of West Side canal near Collinston, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	168	86			6			299	493	512	493
2	148	86			6			418	503	511	476
3	140	80			6			355	512	507	447
4	134	73			6			367	506	507	444
5	148	74			6		37	407	512	508	448
6	144	66			6		64	430	512	499	454
7	139	68			6		105	443	503	503	469
8	140	76	35		6		99	473	506	499	482
9	144	72	33		6		111	472	503	503	473
10	136	62			6		140	477	506	486	459
11	138	59			6		140	464	499	495	461
12	144	78		31	7		155	455	519	496	451
13	144	62		15	6		178	476	508	493	428
14	136	60		6	6		190	470	508	484	418
15	135	54					210	467	464	482	417
16	138	50				37	234	478	467	480	394
17	99	50		4		37	162	382	493	474	390
18	103			7		15	353	493	493	484	378
19	98			7		23	374	508	482	491	343
20	99			7		23	394	510	468	485	360
21	99			7			404	428	486	486	336
22	82			6			324	354	490	464	306
23	84			6			411	386	493	467	305
24	83			6			289	428	494	469	271
25	86			6			162	428	496	493	233
26	85			6			122	428	524	512	235
27	85			6			253	428	522	529	242
28	85			6			320	454	516	525	234
29	87			6			221	460	500	515	240
30	87						290	506	498	532	240
31	88						289		507	519	

NOTE.—Mean discharge estimated, as follows, as stage-discharge relation is believed to have been affected by ice; Nov. 18 to Dec. 7, 45 second-feet; Dec. 10 to Feb. 11, 35 second-feet. No flow in canal Feb. 15–16, Mar. 15 to Apr. 15, and Apr. 21 to May 4.

Monthly discharge of West Side canal near Collinston, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	168	82	117	7,190
November	86		58.0	3,450
December			37.2	2,290
January			35.0	2,150
February		0	17.8	1,020
March	7	0	2.74	168
April	37	0	4.50	268
May	411	0	195	12,000
June	510	299	438	26,100
July	524	464	499	30,700
August	532	464	497	30,600
September	493	233	377	22,400
The year	532	0	190	138,000

NOTE.—See note to table of daily discharge.

HAMMOND (EAST SIDE) CANAL NEAR COLLINSTON, UTAH.

LOCATION.—In NW. ¼ sec. 34, T. 13 N., R. 2 W., at Wheelon siding on Oregon Short Line Railroad, about 400 feet below penstock of Utah Power & Light Co. and 4 miles north of Collinston, Boxelder County.

RECORDS AVAILABLE.—June 1, 1912, to September 30, 1916.

GAGE.—Friez water-stage recorder on right bank, installed May 22, 1914, at same site and datum as inclined staff used until that date; inspected by H. G. Stone.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of earth and gravel. Control not well defined. Canal subject to small slides, which no doubt affect stage-discharge relation.

Extremes of discharge.—1912–1916: Maximum stage occurred in 1916. See monthly discharge table. Mean daily discharge only is available.

Winter flow.—No record during the winter.

Diversions.—Water taken from this canal about 400 feet above gage for power plant.

Regulation.—Flow can be regulated at headgates and by means of a wasteway at power plant fore bay; is also affected by operation of plant.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined for range in stage effective during year. Mean daily gage height obtained from water-stage recorder graph. October 16–22 and May 10–27 staff gage was read. Daily discharge determined by applying mean daily gage height to rating table. Records good.

Cooperation.—Record of mean daily gage height and part of discharge measurements furnished by Utah Power & Light Co.

Canal diverts water on the east side of Bear River in the SW. ¼ sec. 23, T. 13 N., R. 2 W., at the same diversion dam as West Side canal. Part of the water is used by the Wheelon plant of the Utah Power & Light Co. and the rest is either wasted into the river or passes the gaging station for use in irrigation.

Discharge measurements of Hammond (East Side) canal near Collinston, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 27[a]	Purton and Dickinson..	0.96	[b] 0.05	June 13	L. C. Monson..........	4.20	97
May 11	L. C. Monson [c].........	4.20	102	July 17	W. E. Dickinson.......	4.52	115

[a] Slide into canal, 800 feet below gage. [b] Estimated. [c] Engineer, Utah Power & Light Co.

Daily discharge, in second-feet, of Hammond (East Side) canal near Collinston, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	16	5.1	....	72	86	117	118
2	16	5.7	....	83	86	116	128
3	16	5.7	0	83	86	116	125
4	16	4.5	36	82	86	116	124
5	17	3.9	24	82	89	118	123
6	17	4.5	37	85	91	102	121
7	17	5.4	45	88	93	99	120
8	17	5.4	69	94	94	99	122
9	16	5.4	76	92	98	100	126
10	15	5.2	84	94	102	100	124
11	15	5.2	73	97	104	101	117
12	16	2.0	107	98	113	102	113
13	16	3.0	106	98	114	114	112
14	15	4.2	0	98	115	99	106
15	10	4.0	0	98	114	100	102
16	15	4.0	0	96	112	117	106
17	15	2.0	0	97	112	118	106
18	4.5	0	9.0	98	112	120	102
19	4.5	....	44	97	116	122	100
20	4.5	....	76	99	114	120	100
21	4.5	....	82	92	110	118	101
22	4.5	....	73	84	114	120	100
23	4.5	....	83	81	114	120	100
24	4.2	....	88	82	116	118	71
25	3.9	....	90	81	118	116	26
26	3.9	....	74	80	118	118	25
27	3.9	....	74	82	120	117	25
28	4.2	....	54	82	118	117	25
29	4.2	....	6.2	84	118	116	25
30	4.2	....	8.1	84	116	118	32
31	4.5	....	22	....	116	118	....

Note.—Canal reported dry during the winter.

Monthly discharge of Hammond (East Side) canal near Collinston, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	17	3.9	10.5	646
November 1-18	5.7	0	4.18	149
May 3-21	107	0	49.7	2,860
June	99	72	88.8	5,280
July	120	86	107	6,580
August	122	99	113	6,950
September	128	25	94.2	5,610

WEBER RIVER BASIN.

WEBER RIVER NEAR OAKLEY, UTAH.

Location.—In NE. ¼ sec. 15, T. 1 S., R. 6 E., near mouth of canyon about 3 miles above Oakley, Summit County. South Fork of Weber River enters 2 miles above station, and Beaver or Kamas Creek 6 miles below.

Drainage area.—163 square miles.

Records available.—October 22, 1904, to September 30, 1916.

Gage.—Inclined staff on left bank about a quarter of a mile above the upper ditch diverting from Weber River. Read by John Franson.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Bed composed of gravel and boulders; steep and rough but apparently fairly permanent. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 7.0 feet June 13 (discharge, 1,940 second-feet); minimum discharge not determined.

1904–1916: Maximum stage recorded, 8.5 feet July 6, 1907, and June 5–7, 1909 (discharge, 4,010 second-feet); minimum stage, 4.0 feet for periods during February and March, 1908 (discharge, 46 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—None above station but several canals take out below for irrigation use around Oakley and between Oakley and Kamas.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent; affected by ice November 10-19. November 28 to December 4, and December 17 to March 10. Rating curve fairly well defined above 200 second-feet and poorly defined below. Gage read to half tenths once daily except during winter when it was read about twice a week. Daily discharge ascertained by applying daily gage height to rating table except for period when stage-discharge relation was affected by ice. Records obtained by use of rating table for stages above 200 second-feet good; others fair.

Discharge measurements of Weber River near Oakley, Utah, during the year ending Sept. 30, 1916.

[Made by W. E. Dickinson.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
April 19	4.85	288
July 26	4.42	128

Daily discharge, in second-feet, of Weber River near Oakley, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	102	75			124	549	1,240	674	135	92
2	92	75			135	519	995	642	124	92
3	92	75			135	579	846	579	124	92
4	92	75			148	642	1,080	519	124	92
5	92	75	102		148	775	1,420	462	227	84
6	92	75	102		148	919	1,620	408	192	84
7	92	75	102		161	1,160	1,420	358	176	84
8	92	75	92		161	1,160	1,520	358	161	84
9	84	75	92		161	1,240	1,720	358	148	92
10	84		92		176	1,080	1,830	334	148	84
11	84		92	75	176	995	1,830	311	135	84
12	84		92	75	192	846	1,620	289	135	75
13	84		92	75	210	775	1,940	267	124	75
14	84		92	75	227	707	1,830	247	124	75
15	84		92	80	247	642	1,830	247	124	75
16	84		92	84	289	579	1,830	267	124	75
17	84			88	334	549	1,720	247	124	75
18	75			92	408	549	1,620	227	124	75
19	75			102	358	579	1,420	192	112	75
20	75	112		124	267	610	1,340	176	102	75
21	75	112		161	267	642	1,080	176	102	75
22	75	112		192	267	642	995	161	102	75
23	75	112		161	289	642	775	155	102	75
24	75	112		161	358	579	846	150	102	75
25	75	112		148	408	519	846	145	102	75
26	75	112		148	490	462	846	140	92	75
27	75	112		135	579	462	846	102	92	75
28	75			124	741	519	810	102	92	75
29	75			124	775	642	810	92	92	75
30	75			124	642	846	707	135	92	75
31	75			124		1,160		135	92	

Note.—Mean discharge estimated on account of ice as follows: Nov. 10–19, 85 second-feet; Nov. 28–30. 105 second-feet; Dec. 1–4, 100 second-feet; Dec. 17–31, 85 second-feet; Jan. 1 to Feb. 5, 65 second-feet; Feb. 6 to Mar. 10, 70 second-feet.

Monthly discharge of Weber River near Oakley, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet.)
	Maximum.	Minimum.	Mean.	
October	102	75	82.3	5,060
November	112	75	91.2	5,430
December			90.6	5,570
January			65.0	4,000
February			69.2	3,980
March	192		102	6,270
April	775	124	301	17,900
May	1,240	519	728	44,800
June	1,940	707	1,310	78,000
July	674	92	279	17,200
August	227	92	124	7,620
September	92	75	79.6	4,740
The year	1,940		276	201,000

WEBER RIVER AT DEVILS SLIDE, UTAH.

Location.—In SW. ¼ sec. 19, T. 4 N., R. 4 E., about 300 feet north of hotel and 500 feet downstream from highway bridge at Devils Slide, Morgan County. Lost Creek enters from the right a quarter of a mile above the station.

Drainage area.—1,090 square miles.

Records available.—February 1, 1905, to September 30, 1916.

Gage.—Vertical staff on left bank just above cable, installed September 21, 1915, at same site and datum as inclined staff used March 9, 1912, to September 20, 1915. Original gage used February 1, 1905, to March 8, 1912, was an inclined staff at same datum, but on opposite bank of river. Read by A. E. Lucas.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of gravel and sand; shifts occasionally. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 5.65 feet March 21, April 29, and May 7 (discharge, 2,970 second-feet); minimum stage, 2.075 feet September 7 and 8 (discharge, 104 second-feet).

1905–1916: Maximum stage recorded, 7.0 feet May 28 and June 4–8, 1909 (discharge, 5,120 second-feet); minimum discharge, 48 second-feet, September 7 and 8, 1915 (stage 1.78 feet).

Ice.—Stream does not freeze at this point, but there is occasionally a little shore ice; stage-discharge relation not seriously affected.

Diversions.—A number of canals divert water from Weber River and tributaries in the vicinity of Oakley and Kamas for irrigation and domestic use.

Regulation.—None, other than diversions for irrigation.

Accuracy.—Stage-discharge relation permanent throughout the year; not affected by ice. Rating curve well defined between 50 and 1,500 second-feet and fairly well defined up to 3,000 second-feet. Gage read to quarter tenths once a day. Daily discharge ascertained by applying daily gage reading to rating table. Records good.

Discharge measurements of Weber River at Devils Slide, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*
Jan. 20	L. W. Jordan	2.30	164
Apr. 20	W. E. Dickinson	4.10	1,230
July 27	....do	2.34	170

Daily discharge, in second-feet, of Weber River at Devils Slide, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	149	135	195	141	163	141	717	1,970	1,430	559	189	130
2	149	135	157	163	179	157	1,020	1,860	1,330	503	189	130
3	141	141	179	195	195	157	979	1,860	1,150	450	195	130
4	149	141	202	179	212	202	861	2,080	1,330	450	202	122
5	157	149	230	169	202	309	861	2,430	1,530	400	559	115
6	157	141	223	179	212	288	751	2,670	1,640	353	400	110
7	149	179	202	169	202	268	683	2,910	1,750	309	400	106
8	149	163	169	157	212	268	717	2,790	1,750	309	331	106
9	149	163	189	212	195	268	823	2,730	1,860	268	309	110
10	141	179	189	195	212	376	979	2,670	1,860	268	288	115
11	141	163	179	169	212	425	1,530	2,430	1,970	249	268	157
12	149	149	179	179	212	450	1,430	2,190	1,860	223	268	149
13	149	157	169	179	196	531	1,150	1,970	1,860	202	249	141
14	149	157	195	179	179	503	1,240	1,640	1,970	202	230	141
15	149	223	179	179	179	503	1,430	1,430	1,970	223	230	149
16	141	212	130	195	189	559	1,430	1,330	1,860	309	230	141
17	149	157	122	189	189	651	1,640	1,150	1,860	288	223	135
18	149	202	122	163	189	823	1,750	1,110	1,750	249	195	135
19	149	223	115	179	179	979	1,530	1,060	1,750	230	169	135
20	149	249	149	169	179	1,430	1,330	1,150	1,640	223	169	135
21	149	230	163	163	179	2,910	1,240	1,150	1,330	223	179	130
22	149	230	202	179	212	1,750	1,150	1,150	1,150	202	166	135
23	141	202	230	195	212	1,970	1,240	1,150	979	195	163	157
24	141	202	195	195	212	1,150	1,530	1,060	939	189	157	149
25	141	149	169	189	195	787	1,750	1,020	899	223	149	149
26	141	195	169	179	189	823	1,970	979	899	195	149	149
27	149	179	130	163	223	899	2,430	899	823	176	149	149
28	149	141	141	169	189	1,060	2,790	861	787	179	135	149
29	149	169	149	157	163	924	2,910	899	683	195	135	149
30	149	212	141	149	....	787	2,430	1,060	619	195	141	141
31	141	....	135	156	....	651	....	1,330	....	195	135	....

Monthly discharge of Weber River at Devils Slide, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	157	141	147	9,040
November	249	135	178	10,600
December	230	115	171	10,500
January	212	141	175	10,800
February	223	163	195	11,200
March	2,910	141	742	45,600
April	2,910	683	1,480	88,100
May	2,910	861	1,640	101,000
June	1,970	619	1,440	85,700
July	559	176	272	16,700
August	559	135	224	13,800
September	157	106	135	8,030
The year	2,910	106	566	411,000

WEBER RIVER NEAR PLAIN CITY, UTAH.

Location.—In SE. ¼ sec. 5, T. 6 N., R. 2 W., at county highway bridge on road to Ogden, Weber County, a mile from Plain City, about a mile below mouth of Fourmile Creek, 2 miles below Mill Creek, 6 miles below Ogden River, and 6 miles above point where Weber River flows into Great Salt Lake.

Drainage area.—2,060 square miles.

Records available.—May 14, 1905, to September 30, 1916. Records were obtained at this point in 1904 by the State engineer of Utah.

Gage.—Chain gage on upstream side of highway bridge installed November 12, 1914, at same datum as old gage. Gage used 1904 to November 11, 1914, was painted on upstream side of middle pier of bridge. Gage read by W. E. Davies.

Discharge measurements.—Made from bridge or by wading. Conditions fair.

Channel and control.—Bed composed of sand and mud. Shifting. One channel at all stages; banks high.

Extremes of discharge.—Maximum stage recorded during year, 18.7 feet at 6 a. m. March 22 (discharge, 6,730 second-feet); water standing in pools July 30 to August 4. Stage below 2.0 feet.

1904–1916: Maximum stage recorded, 19.1 feet June 6, 1909 (discharge, 7,580 second-feet); water standing in pools July 14 and 15, 1915, and July 30 to August 4, 1916. Stage below 2.0 feet.

Ice.—River occasionally freezes over during very cold weather. Discharge for such periods determined by comparison with record of flow at Devils Slide.

Diversion.—In the summer practically the entire flow of Weber River above this station is used for irrigation.

Regulation.—Flow affected by diversions.

Accuracy.—Stage-discharge relation not permanent for stages below 10 feet; affected by ice during winter. Rating curves fairly-well defined except that below 50 second-feet they may be considerably in error. Gage read to quarter-tenths once a day. Daily discharge determined by applying daily gage height to rating tables, except for ice-affected periods and days in August and September when water did not reach gage. Records fair.

Discharge measurements of Weber River near Plain City, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan 21	L. W. Jordan	[a] 6.12	388
Apr. 11	Jordan and Dickinson	14.00	3,470
June 26	A. B. Purton	6.30	877

[a] Stage discharge relation affected by ice.

Daily discharge, in second-feet, of Weber River near Plain City, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	256	228	374			709	2,720	5,530	1,660	277	0	
2	256	228	351			653	3,320	4,640	1,800	277	0	
3	237	220	351			653	3,510	4,250	1,630	277	0	
4	237	220	374			653	3,100	4,020	1,530	159	0	
5	237	220	398			1,000	2,960	4,500	1,600	159	50	
6	237	220	398	446	599	1,260	2,720	4,920	1,730	88	224	
7	246	285	422	422	653	1,070	2,500	4,440	1,900	42	224	
8	246	306	374	374	709	1,000	2,470	5,370	1,800	31	191	
9	256	265	374	398	681	973	2,640	5,300	2,030	31	159	
10	265	328	374		737	1,220	2,960	4,640	1,860	31	129	
11	256	374	398		709	1,560	3,650	4,250	1,800	30	101	
12	246	306	398		681	1,820	3,700	3,700	1,900	20	63	
13	202	328	374		653	2,060	3,960	3,240	1,860	10	29	
14	211	328	374		626	2,200	3,550	3,030	1,760	10	29	
15	202	328	398		599	1,990	3,650	2,750	1,730	10		
16	220	328	422		599	2,060	3,850	2,500	1,630	52		
17	228	351	398		626	2,300	4,250	2,370	1,600	47		
18	237	351	374		626	2,860	4,640	2,230	1,560	41		
19	237	374	351		599	3,320	4,710	2,200	1,500	41		
20	246	374	351		626	4,500	3,910	2,370	1,470	41		
21	237	398	374	388	653	5,940	3,460	2,330	1,470	41		
22	237	446	422		681	6,460	3,140	2,300	1,500	33		15
23	237	446	446		681	6,200	3,030	2,130	1,370	30		25
24	228	446	471		653	5,860	3,170	2,060	1,000	25		39
25	237	374	471		681	4,380	3,600	1,990	970	20		39
26	237	328	422	496	709	3,460	4,380	1,900	882	20		49
27	237	374	398	446	737	3,510	5,220	1,700	711	20		61
28	237	422			795	3,650	5,700	1,700	655	20		61
29	237	328			766	3,600	6,030	1,470	548	20		61
30	237	374				3,240	6,030	1,470	379	0		61
31	237					3,030		1,560		0		

NOTE.—Discharge estimated on account of ice as follows: Dec. 28–31, 350 second-feet; Jan. 1–5, 375 second-feet; Jan. 10–20, 420 second-feet; Jan. 22–25, 435 second-feet; Jan. 28–31, 385 second-feet; Feb. 1–5, 460 second-feet. Discharge estimated as water did not reach gage, Aug. 5; mean flow Aug. 15 to Sept. 21, 10 second-feet; Sept. 22 and 23.

Monthly discharge of Weber River near Plain City, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	265	202	257	15,800
November	446	220	330	19,600
December	471		388	23,900
January			411	25,300
February	795		634	36,500
March	6,460	653	2,680	165,000
April	6,030	2,470	3,750	223,000
May	5,530	1,470	3,120	192,000
June	2,030	379	1,460	86,900
July	277	0	61.4	3,780
August	224	0	44.2	2,720
September	61		20.7	1,230
The year	6,460	0	1,100	795,000

JORDAN RIVER BASIN.

JORDAN RIVER NEAR LEHI, UTAH.

LOCATION.—In sec. 25, T. 5 S., R. 1 W., about 800 feet below pump house at outlet of Utah Lake and 4 miles southwest of Lehi, Utah County.

DRAINAGE AREA.—2,570 square miles.

RECORDS AVAILABLE.—May 30 to December 31, 1904; July 22, 1913, to September 30, 1916.

Gage.—Vertical staff in stilling well on right bank about 25 feet above bridge January 6, 1914, to September 30, 1916; read by W. A. Knight. Gage used May 30 to December 31, 1904, and July 22, 1913, to January 5, 1914, was vertical staff nailed to upstream side of right bridge abutment; same datum 1904-1916.

Discharge measurements.—Made from cable about 400 feet above gage or by wading.

Channel and control.—Bed composed of clay and hardpan. Banks clean and low; not subject to overflow. One channel at the gage. Area slightly constricted below by highway bridge. Slope is very flat and stage-discharge relation may be slightly affected when flashboards are placed on the old impounding dam in Jordan Narrows, 6 miles north of the station (12 miles by river).

Extremes of discharge.—Maximum stage during year, 5.50 feet, July 25, with pumps running (discharge, 755 second-feet). Minimum stage occurred at 6 p. m. on December 15 when river was dry due to a strong north wind which blew the water in the lake away from the outlet gates.

1904, 1913–1916: Maximum stage recorded, 5.78 feet May 31, 1914 (discharge, 794 second-feet); minimum stage occurred at 6 p. m. December 15, 1915, when river was dry.

Ice.—Stage-discharge relation seldom seriously affected by ice. During unusually cold weather, however, the river sometimes freezes over below station and the open-channel rating is not applicable.

Diversions.—None above the station. In the Narrows about 6 miles north (several miles farther by river) a number of large canals divert for irrigation in Salt Lake Valley and for use by the smelters, etc., in the vicinity of Garfield.

Regulations.—During the irrigation season, when the natural flow from Utah Lake is inadequate for the demands below, water is pumped from the lake into Jordan River. A pumping plant with a capacity of about 800 cubic-feet per second is at outlet of lake, 800 feet above gage, and is owned and operated by various canal companies interested in the stream.

Accuracy.—Stage-discharge relation not permanent, because of slight shifts in control, variable effect of wind on both river and lake, increased velocities due perhaps to pumping, and possible backwater from flashboards on dam at Jordan Narrows. There seem to be in general two conditions of stage-discharge relation—one existing when the river is fed by gravity flow from the lake with the check gates wide open, and the other when the pumps are in operation and the check gates closed. No ice effect during the year. Four fairly well defined rating curves used. Gage read to hundredths twice daily. Daily discharge determined by applying mean daily gage height to rating table. Records fair. Wind effect serious and the amount uncertain; discharge for windy days may be considerably in error, but total discharge is probably not seriously affected.

Discharge measurements of Jordan River near Lehi, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	A. B. Purton	2.76	226	June 24	A. B. Purton	5.00	651
Nov. 6	.....do	2.25	156	Sept. 23	J. J. Sanford	4.36	469
Feb. 7	J. J. Sanford	2.30	168	29	.....do	3.81	367
Apr. 14	W. E. Dickinson	4.45	509	29	.....do	3.81	378
14	L. W. Jordan	[a]4.40	398				

[a] Strong wind upstream affected stage-discharge relation.

Daily discharge, in second-feet, of Jordan River near Lehi, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	284	230	99	35	144	354	485	570	570	650	726	652
2	234	206	100	35	147	356	428	568	570	650	726	650
3	234	159	101	38	149	361	492	574	568	650	726	648
4	233	156	102	42	152	356	494	582	567	648	724	646
5	234	156	103	45	154	379	392	586	550	658	692	646
6	233	156	105	46	157	385	500	487	534	682	660	646
7	238	156	107	46	162	383	502	487	563	688	688	650
8	231	156	105	48	163	383	464	588	559	688	688	652
9	230	156	98	54	184	387	506	586	557	688	688	646
10	233	156	93	57	212	387	504	588	555	686	688	642
11	231	141	93	62	255	383	508	464	553	684	688	628
12	231	114	93	70	286	385	500	589	550	682	688	594
13	230	114	93	80	286	329	466	589	540	702	686	586
14	230	90	63	90	291	385	512	597	540	702	690	582
15	233	86	28	88	296	388	513	591	690	704	690	580
16	231	82	108	94	301	392	716	591	692	698	667	582
17	230	81	114	96	306	392	523	597	702	711	642	586
18	230	82	120	114	311	399	527	593	696	724	644	586
19	228	81	88	118	315	401	530	483	679	726	644	580
20	230	82	88	120	317	406	534	464	682	734	640	582
21	228	83	88	122	318	406	540	589	650	736	652	580
22	230	86	88	123	324	410	544	591	644	738	665	560
23	230	88	88	125	327	419	546	559	644	736	660	465
24	230	70	88	125	331	424	550	584	648	734	650	452
25	233	93	91	126	334	433	553	589	646	755	650	454
26	230	68	98	129	338	433	559	586	652	732	652	445
27	228	78	107	131	338	338	561	561	654	732	654	434
28	230	97	113	133	342	444	565	578	650	730	654	420
29	228	98	78	135	347	303	428	576	650	730	652	373
30	230	100	29	140	....	374	512	570	650	732	646	338
31	230	....	32	142	....	474	....	572	....	728	652	....

NOTE.—Rating curves applicable as follows: One, Oct. 1 to Nov. 13, Feb. 1–10, and June 15 to Sept. 21; one, Nov. 15–21, Feb. 11–12, and Feb. 19 to June 14; one, Nov. 22 to Dec. 29; and one, Sept. 23–30. Indirect method for shifting control, Dec. 30 to Jan. 31, and Sept. 22. Discharge interpolated Feb. 13–18, June 29, and July 11, 17, and 21. Discharge estimated Nov. 14, Dec. 15, Apr. 12, and Sept. 22.

Monthly discharge of Jordan River near Lehi, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	284	228	233	14,300
November	230	68	117	6,960
December	120	28	90.2	5,550
January	142	35	90.6	5,570
February	347	144	262	15,100
March	474	303	389	23,900
April	716	392	515	30,600
May	597	464	565	34,700
June	702	534	612	36,400
July	755	648	704	43,300
August	726	640	673	41,400
September	652	338	563	33,500
The year	755	28	402	291,000

SUMMIT CREEK NEAR SANTAQUIN, UTAH.

Location.—In sec. 12, T. 10 S., R. 1 E., at power plant of Utah Power & Light Co., about a mile from Santaquin, Utah County.

Drainage area.—27.5 square miles.

Records available.—March 8, 1910, to September 30, 1916.

Gage.—Hook gage at a 4-foot, rectangular, sharp-crested weir with complete end contractions, in the power-plant tailrace, and a vertical staff above a similar 5-foot weir in the main creek; there is also a vertical staff fastened to a cottonwood tree on left bank of creek about 250 yards above the power house. Gage reader, William Broadbent.

Discharge measurements.—Made by wading.

Channel and control.—Bed of rocks and coarse gravel; may shift slightly. Banks high and clean. Controls for both gages formed by weirs. One channel at all stages at upper gage in creek.

Extremes of discharge.—Maximum discharge reported during year, 97 second-feet, April 28; minimum discharge reported, 1.9 second-feet, January 28.

1910–1916: Maximum discharge reported, 150 second-feet, May 10, 1910; minimum discharge reported, 1.9 second-feet, January 28, 1916.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Above all irrigation diversions.

Regulation.—Flow may be affected at times by operation of power plant.

Accuracy.—No definite information.

Cooperation.—Record of daily discharge furnished by Utah Power & Light Co.

This record gives the total flow of the creek obtained by combining the flow in the tailrace and the flow in the main creek.

No discharge measurements made during the year.

Daily discharge, in second-feet, of Summit Creek near Santaquin, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.2	7.5	7.4	6.3	6.0	6.4	13	61	64	19	11	9.1
2	8.2	7.5	6.9	6.3	5.9	6.0	14	52	54	19	12	9.5
3	8.5	7.5	6.9	6.4	5.9	6.2	13	54	51	18	11	9.1
4	8.2	7.5	7.5	6.2	5.9	6.3	14	62	59	17	11	9.1
5	8.2	7.2	6.6	6.3	5.9	6.6	14	66	59	17	11	8.8
6	8.2	7.2	7.1	6.4	5.9	6.6	14	71	61	17	11	8.6
7	8.2	8.8	6.9	5.7	5.7	6.6	13	71	66	16	11	8.6
8	8.2	7.8	6.9	6.8	5.0	6.6	13	83	59	16	11	9.6
9	8.2	8.0	6.9	5.7	5.0	6.9	14	81	62	16	11	9.8
10	8.2	7.8	6.4	5.6	5.7	6.9	16	71	54	15	10	9.6
11	8.5	7.2	6.6	5.7	5.4	6.9	25	71	54	15	10	9.5
12	8.6	7.8	6.4	5.6	6.0	6.9	21	66	52	14	10	9.0
13	8.2	7.7	6.6	6.0	6.0	6.9	19	61	51	14	10	8.8
14	8.0	5.0	6.6	6.9	6.0	6.9	20	54	51	14	10	9.0
15	8.3	7.8	6.4	6.6	6.0	6.9	22	59	48	13	10	9.0
16	7.8	7.2	5.6	6.6	6.0	6.9	23	57	44	13	10	8.6
17	7.7	7.1	6.6	6.8	6.0	6.9	28	60	45	13	10	8.6
18	7.7	7.7	6.0	2.4	6.0	8.5	31	42	44	13	10	8.3
19	7.8	7.5	5.6	5.6	6.0	11	24	59	33	12	10	8.6
20	7.7	7.5	6.6	6.6	6.0	14	20	59	31	12	10	8.5
21	7.7	7.5	6.8	6.6	6.3	25	21	45	27	12	10	8.8
22	7.7	7.5	6.6	6.8	6.3	22	22	46	24	11	10	8.5
23	7.7	7.5	6.8	6.8	6.0	21	26	45	22	11	10	8.5
24	7.7	6.9	6.2	6.6	6.3	16	32	45	22	11	9.6	8.6
25	7.7	6.2	6.6	6.6	6.4	16	46	45	21	11	9.5	8.6
26	7.7	7.9	6.6	5.9	6.4	15	45	46	21	12	9.6	8.8
27	7.7	7.8	6.2	6.6	6.4	15	65	50	20	12	9.3	8.8
28	7.7	3.8	6.3	1.9	6.3	16	97	50	20	12	9.1	8.6
29	7.7	7.2	5.7	2.4	6.4	15	64	56	20	11	9.0	8.5
30	7.7	7.4	6.2	3.8	......	14	57	60	20	11	9.1	8.5
31	7.7	......	6.3	3.6	......	13	......	60	......	11	9.1	......

Monthly discharge of Summit Creek near Santaquin, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8.6	7.7	7.98	491
November	8.8	3.8	7.30	434
December	7.5	5.6	6.54	402
January	6.9	1.9	5.75	354
February	6.4	5.0	5.97	343
March	25	6.0	10.8	664
April	97	13	28.2	1,680
May	83	42	58.3	3,580
June	64	20	41.6	2,480
July	19	11	13.8	848
August	12	9.0	10.1	621
September	9.8	8.3	8.86	527
The year	97	1.9	17.1	12,400

PETEETNEET CREEK NEAR PAYSON, UTAH.

Location.—In SE. ¼ SW. ¼ sec. 29, T. 9 S., R. 2 E., about half a mile above power canal intake and 3 miles above Payson, Utah County.

Drainage area.—28 square miles.

Records available.—August 1, 1910, to September 30, 1916; miscellaneous measurements, 1909–10.

Gage.—Inclined staff on left bank.

Discharge measurements.—Made from footbridge at gage or by wading.

Channel and control.—Bed composed of rocks and gravel; may shift during extremely high water. Banks high and not subject to overflow.

Extremes of discharge.—Maximum discharge reported during year, 165 second-feet April 27; minimum discharge reported, 4.3 second-feet December 31.

1910–1916: Maximum stage reported, 4.02 feet May 10, 1914 (discharge, 200 second-feet); minimum stage, 1.44 feet December 28, 1912 (discharge, 1.7 second-feet).

Ice.—Stage-discharge relation possibly affected by ice for a few days in January. Open-water rating curves used.

Diversions.—None above the station.

Regulation.—City of Payson has constructed several small reservoirs above the station which regulate the flow to some extent.

Cooperation.—Since January 1, 1911, records have been furnished by the United States Reclamation Service.

Discharge measurements of Peteetneet Creek near Payson, Utah, during year the ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 26	R. M. Adams	2.14	5.4	July 6	E. L. McGrath	2.38	10.2
Apr. 21	do	2.78	45.8	28	Adams and Saxton	2.40	10.8
May 30	E. L. McGrath	2.69	29.0	Sept. 4	Adams and Jones	2.33	9.0
30	R. M. Adams	2.67	26.7	27	Jones and Saxton	2.34	7.7

Daily discharge, in second-feet, of Peteetneet Creek near Payson, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.7	6.3	6.8	5.5	8.0	9.5	13.2	110.0	37.3	11.3	10.4	8.8
2	8.0	6.3	7.4	6.7	8.0	9.8	13.2	126.0	33.6	11.7	11.0	8.8
3	7.4	6.5	7.0	6.8	8.0	10.1	13.2	141.0	29.5	12.0	11.7	8.8
4	7.4	6.8	6.6	6.9	8.2	10.4	13.4	150.0	25.4	12.4	12.0	8.8
5	7.4	7.1	6.6	7.9	8.5	10.4	13.7	159.0	23.8	11.7	12.4	8.6
6	6.8	7.4	6.6	7.2	8.6	10.4	13.7	144.0	22.1	11.0	12.0	8.4
7	6.3	7.4	6.8	7.1	8.8	10.1	13.7	128.0	20.8	10.7	11.7	8.6
8	6.3	7.4	7.1	7.0	9.3	9.8	15.2	114.0	19.4	10.4	11.4	8.8
9	6.3	7.1	7.1	8.4	9.8	10.0	16.6	99.0	18.8	10.4	11.0	8.6
10	6.3	6.8	7.1	9.7	9.7	10.1	17.7	86.0	18.3	10.4	10.7	8.4
11	6.3	6.5	7.0	12.1	9.5	9.8	18.8	72.0	18.3	10.4	10.4	8.4
12	6.5	6.3	6.8	12.4	9.8	9.5	20.4	82.0	18.3	10.4	10.4	8.4
13	6.8	6.3	6.8	11.2	10.1	9.8	22.1	91.0	17.4	10.1	10.4	9.1
14	6.8	6.3	6.8	10.0	10.4	10.1	22.9	70.0	16.6	9.8	10.1	9.3
15	6.8	6.5	6.5	8.7	10.7	10.1	23.7	49.0	15.8	9.8	9.8	9.5
16	6.6	6.8	6.3	7.5	10.1	10.1	27.2	56.0	15.0	9.8	9.6	9.5
17	6.3	6.5	6.3	7.7	9.5	10.1	30.6	64.0	15.0	9.4	9.3	9.5
18	6.3	6.3	6.3	7.9	9.8	10.1	32.6	80.0	15.0	9.1	9.3	9.3
19	6.3	6.5	6.5	7.9	10.1	10.2	34.5	96.0	14.6	9.1	9.3	9.1
20	6.4	6.8	6.8	7.9	10.1	10.4	39.4	92.0	14.1	9.1	9.1	9.4
21	6.6	6.8	7.0	8.2	10.1	10.6	44.2	88.0	13.4	9.3	8.8	9.8
22	6.5	6.8	7.1	8.4	10.2	10.7	56.8	69.0	12.8	9.5	8.8	9.8
23	6.3	7.1	6.8	8.2	10.4	10.4	69.5	50.0	12.8	9.5	8.8	9.8
24	6.3	7.4	6.6	8.1	10.0	9.8	102.0	56.0	12.8	9.5	8.6	9.6
25	6.3	7.1	6.1	7.9	9.8	10.2	134.0	63.0	12.4	9.3	8.4	9.4
26	6.5	6.8	5.6	7.8	9.8	10.7	150.0	67.0	12.1	9.1	8.4	9.3
27	6.8	6.8	5.3	8.0	9.8	11.4	165.0	71.0	11.6	8.8	8.4	8.8
28	6.8	6.8	5.0	8.2	9.5	12.1	115.0	67.0	11.0	8.6	8.6	8.8
29	6.8	6.8	4.8	8.0	9.3	11.4	65.6	63.0	11.0	9.0	8.8	8.8
30	6.5	6.8	4.5	7.8	....	10.7	80.4	52.0	11.0	9.5	9.1	8.8
31	6.3	....	4.3	7.9	....	11.9	....	41.0	....	10.0	9.3	....

Monthly discharge of Peteetneet Creek near Payson, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8.7	6.3	6.70	412
November	7.4	6.3	6.77	403
December	7.4	4.3	6.40	394
January	12.4	5.5	8.22	505
February	10.7	8.0	9.51	547
March	12.1	9.5	10.3	633
April	165	13.2	46.6	2,770
May	159	41	87.0	5,350
June	37.3	11.0	17.7	1,050
July	12.4	8.6	10.0	615
August	12.4	8.4	9.94	611
September	9.8	8.4	9.03	537
The year	165	4.3	19.1	13,800

NOTE.—Monthly discharge computed by United States Geological Survey.

SPANISH FORK AT THISTLE, UTAH.

LOCATION.—In SW. ¼ SW. ¼ sec. 28, T. 9 S., R. 4 E., in Thistle, Utah County, about 800 feet below point at which Soldier Fork and Thistle Creek unite to form Spanish Fork, and 3 miles above Diamond Fork.

DRAINAGE AREA.—490 square miles.

RECORDS AVAILABLE.—December 3, 1907, to September 30, 1916.

GAGE.—Inclined staff on right bank 10 feet below cable. Used May 4, 1915, to September 30, 1916; read daily by Mrs. Effie Gordon. November 21, 1912, to May 3, 1915, a vertical staff on right bank at same site and datum. December 3, 1907, to November 20, 1912, a vertical staff on left bank about a mile downstream.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Bed composed of gravel and sand. One channel at all stages. Left bank low and subject to overflow; right bank high and partly wooded. Channel straight for 100 feet above and 600 feet below gage. Gravel bar about 30 feet below gage, shifting.

Extremes of discharge.—Maximum stage reported during year, 6.15 feet May 9 (discharge, 822 second-feet); minimum stage, 3.90 feet November 12 (discharge, 34.0 second-feet).

1907-1916: Maximum discharge reported, 920 second-feet May 10, 1914; minimum discharge, 18.5 second-feet December 20, 1913.

Ice.—Stage-discharge relation affected by ice for short periods.

Diversions.—No important diversions above the station.

Regulation.—None.

Cooperation.—Records since January 1, 1911, furnished by United States Reclamation Service.

Discharge measurements of Spanish Fork at Thistle, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 19	R. M. Adams	4.02	47.2	Aug. 11	Jones and Saxton	4.22	55
May 5	....do	5.75	587	23	Adams and Saxton	4.16	51
June 10	McGrath and Saxton	4.94	215	30	Adams and Jones	4.12	43.1
22	Adams and Saxton	4.68	140	Sept. 12	....do	4.16	50
July 27	....do	4.42	86				

Daily discharge, in second-feet, of Spanish Fork at Thistle, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept
1	42.1	42.1	38.9	....	535	297	94.3	61.4	43.0
2	38.9	45.3	52.1	....	535	318	86.7	61.4	44.0
3	40.5	46.9	54.1	....	562	284	86.7	61.4	44.0
4	42.1	43.7	59.8	....	590	276	86.7	61.4	43.0
5	43.7	43.7	54.1	....	590	276	84.8	60.1	44.0
6	43.7	43.7	54.1	....	686	269	81.0	60.1	43.0
7	42.1	57.9	54.1	....	709	242	81.0	58.8	42.0
8	42.1	50.2	54.1	....	732	235	81.0	58.8	41.0
9	40.5	52.1	54.1	....	822	225	86.7	54.9	45.0
10	37.2	46.9	54.1	....	720	215	77.6	53.6	45.0
11	35.6	45.3	54.1	208	690	225	74.2	51.0	46.0
12	37.2	34.0	45.3	225	657	215	74.2	49.0	46.0
13	43.7	46.9	59.8	208	674	205	74.2	58.8	47.0
14	45.3	42.1	56.0	202	635	192	94.3	54.9	48.0
15	50.2	37.2	56.0	228	590	183	75.9	52.3	48.0
16	46.9	54.1	50.2	249	456	173	81.0	53.6	47.0
17	46.9	42.1	42.1	259	431	164	81.0	52.3	46.0
18	46.9	54.1	38.9	276	416	153	74.2	51.0	46.0
19	46.9	63.7	43.7	249	431	144	64.0	51.0	46.0
20	43.7	59.8	46.9	215	406	147	64.0	50.0	46.0
21	40.5	56.0	46.9	205	396	144	62.7	49.0	46.0
22	46.9	54.1	50.2	208	416	144	53.6	48.0	46.0
23	43.7	54.1	52.1	259	397	132	60.1	48.0	46.0
24	43.7	59.8	....	446	397	124	61.4	47.0	45.0
25	43.7	45.3	....	456	361	121	69.1	45.0	45.0
26	48.6	56.0	....	466	339	117	75.9	41.0	45.0
27	48.6	42.1	....	535	328	110	90.5	41.0	47.0
28	48.6	38.9	....	618	318	108	72.5	41.0	48.0
29	48.6	54.1	....	618	318	102	72.5	42.0	49.0
30	48.6	50.2	....	618	322	102	64.0	43.0	49.0
31	45.3	....	....	....	322	....	62.7	43.0	....

Note.—No record Dec. 24 to Apr. 10.

Monthly discharge at Spanish Fork at Thistle, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	50.2	35.6	44.0	2,710
November	63.7	34.0	48.8	2,900
December 1-23	59.8	38.9	50.9	2,320
April 11-30	618	202	337	13,400
May	822	318	509	31,300
June	318	102	188	11,200
July	94.3	53.6	75.8	4,660
August	69.1	41.0	52.3	3,220
September	49.0	41.0	45.5	2,710

NOTE.—Monthly discharge computed by U. S. Geological Survey.

SPANISH FORK NEAR SPANISH FORK, UTAH.

LOCATION.—In SW. ¼ sec. 2, T. 9. S., R. 3 E., about half a mile below United States Reclamation Service diversion dam of Strawberry Valley project, half a mile above intake of East Bench canal, 5 miles southeast of Spanish Fork, Utah County.

DRAINAGE AREA.—670 square miles.

RECORDS AVAILABLE.—May 23, 1900, to November 30, 1901; March 26, 1903, to September 30, 1916.

GAGE.—Inclined staff on right bank January 1, 1913, to September 30, 1916; original gage inclined staff on right bank about 600 feet above East Bench canal heading, May 23, 1900, to November 30, 1901, and March 26, 1903, to July 31, 1912; temporary gage one-fourth mile above original gage, August 1 to December 31, 1912.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and rocks; one channel at all stages; straight for about 200 feet above and 150 feet below gage. Banks high amd may cave off during floods. Water is turbulent and control generally shifts during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.08 feet March 21 (discharge, 879 second-feet); minimum stage, river dry December 19, 20, and February 6.

1900–1916: Maximum stage recorded, 6.0 feet May 21, 1907, (discharge, 1,970 second feet); minimum stage, river dry at several different times when entire flow was being diverted at Reclamation Service dam.

ICE.—Stage-discharge relation affected by ice at times.

DIVERSIONS.—Above all important diversions except the United States Reclamation Service power canal which supplies the high line canal, the power plant, and the Salem canal; water can also be returned to the river at the power plant. In 1916 this canal diverted 85,000 acre-feet.

The Strawberry reservoir (present capacity about 250,000 acre-feet) has been constructed to store the waters of Strawberry River, a stream in the Colorado River Basin; this water can be diverted to the Spanish Fork basin by means of a tunnel.

REGULATION.—Natural flow affected by diversion by the United States Reclamation Service half a mile above the station and will also be affected whenever water is supplied from the Strawberry reservoir.

COOPERATION.—Since January 1, 1911, records have been furnished by the United States Reclamation Service.

Discharge measurements of Spanish Fork near Spanish Fork, Utah, during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Dis-charge.	Date.		Made by—	Gage height.	Dis-charge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Mar.	22	R. M. Adams	6.86	507	July	5	E. L. McGrath	4.89	130
	22	.....do	6.65	466		27	Adams and Saxton	4.93	137
Apr.	11	.....do	7.50	514	Aug.	9	Jones and Saxton	4.20	44
May	8	.....do	8.70	787		15	.....do	4.45	71
	9	.....do	8.67	848		22	.....do	4.43	66
	17	.....do	6.48	372		31	.....do	4.50	77
June	8	E. L. McGrath	5.32	187	Sept.	6	.....do	4.47	77
	20	.....do	5.05	163		18	.....do	4.40	66
July	3	.....do	4.88	130		25	.....do	4.42	67
	4	.....do	4.74	110					

Daily discharge, in second-feet, of Spanish Fork near Spanish Fork, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	14.5	8.8	8.8	......	......	44.1	266	552	237	147	106.0	75.5
2	9.8	8.8	8.8	......	......	46.7	381	522	226	147	102.0	75.5
3	9.8	8.8	11.3	......	......	45.4	297	496	209	151	83.5	75.5
4	12.1	8.8	16.0	23.2	25.0	51.7	140	496	212	119	80.7	71.6
5	12.9	9.3	14.5	23.2	25.9	94.0	381	634	209	138	87.0	70.3
6	12.1	10.6	14.5	23.2	0	88.0	354	681	204	138	94.0	76.8
7	12.1	23.2	11.3	......	19.6	82.0	321	756	201	137	83.5	75.5
8	12.1	17.6	10.6	......	24.1	83.5	216	756	193	139	41.6	79.4
9	11.3	16.0	12.9	35.3	27.7	105.8	354	788	198	151	46.7	82.0
10	9.3	17.6	14.5	26.8	28.6	148.2	270	638	201	154	42.9	80.7
11	6.9	12.1	12.9	......	36.5	164	514	654	206	160	36.5	80.7
12	7.9	6.4	6.9	27.7	41.6	166	510	618	193	164	46.7	80.7
13	9.8	12.9	14.5	37.8	36.5	188	467	522	189	164	82.0	79.4
14	10.6	14.5	14.5	19.6	36.5	196	474	482	182	166	78.1	66.2
15	13.7	8.8	16.0	25.0	39.1	198	447	425	174	174	74.2	69.0
16	14.5	14.5	7.9	25.0	37.8	229	507	376	178	179	76.8	66.2
17	14.5	11.3	5.3	25.0	37.8	258	537	359	173	171	76.8	64.8
18	14.5	12.1	2.7	......	46.6	254	556	340	181	138	80.7	64.8
19	13.7	14.5	0	......	46.7	333	505	195	175	137	79.4	66.2
20	13.7	16.0	0	29.5	44.1	314	442	342	165	141	74.2	71.6
21	12.9	16.8	2.9	......	44.1	879	392	345	166	140	71.6	71.6
22	12.1	16.0	7.6	......	46.7	552	404	330	164	125	71.6	72.9
23	10.6	15.2	11.3	25.0	46.7	562	458	319	152	123	75.5	70.3
24	9.3	17.6	11.3	26.8	46.7	303	542	308	147	128	75.5	70.3
25	9.3	8.8	11.3	26.8	46.6	320	626	337	147	132	72.9	67.6
26	11.3	16.0	11.3	31.3	47.5	381	556	280	134	135	72.9	67.6
27	12.1	16.0	11.3	......	51.7	324	687	268	138	140	74.2	66.2
28	12.1	12.4	11.3	......	63.4	408	789	253	142	140	74.2	69.0
29	11.3	8.8	11.3	......	54.2	366	846	227	131	137	78.1	54.2
30	10.6	14.5	11.3	......	......	351	687	227	131	122	76.8	52.5
31	10.6	......	11.3	......	......	320	......	232	......	104	76.8	......

NOTE.—Stage-discharge relation affected by ice at times from Jan. 1 to Feb. 3; mean discharge for periods not estimated.

Monthly discharge of Spanish Fork near Spanish Fork, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	14.5	6.9	11.5	707
November	23.2	6.4	13.2	786
December	16.0	0	10.8	664
February 4-29	63.4	0	38.9	2,010
March	879	44.1	253	15,600
April	846	140	464	27,600
May	788	195	444	27,300
June	237	131	179	10,700
July	179	104	143	8,790
August	106	41.6	74.0	4,550
September	82.0	52.5	71.2	4,240

NOTE.—Monthly discharge computed by United States Geological Survey.

SPANISH FORK AT LAKE SHORE, UTAH.

LOCATION.—In NE. ¼ sec. 15, T. 8 S., R. 2 E., about a mile east of Lake Shore, Utah County, 3 miles above mouth and about 3 miles northwest of Spanish Fork; below all tributaries and diversions.

DRAINAGE AREA.—700 square miles.

RECORDS AVAILABLE.—December 10, 1903, to July 10, 1907; March 10, 1909, to September 30, 1916.

GAGE.—Inclined staff with vertical low-water extension, on right bank about half a mile below highway bridge March 10, 1909, to September 30, 1916; original gage vertical staff on left bank immediately below bridge December 10, 1903, to May 25, 1904; gage at the old cable 800 feet above the bridge May 26, 1904, to July 10, 1907.

DISCHARGE MEASUREMENTS.—Made from cable at present gage or by wading.

CHANNEL AND CONTROL.—Bed soft; fairly permanent. One channel at all stages; banks of earth, high and clean.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.85 feet April 29 (discharge, 792 second-feet); minimum stage, river dry August 7-16, and August 21 to September 8.

1903-1916: Maximum stage recorded, 16.0 feet May 11, 1909 (discharge, 1,430 second-feet); minimum stage occurred in 1916, see preceding paragraph.

ICE.—Stage-discharge relation slightly affected by ice for short periods.

DIVERSIONS.—Entire flow is diverted above station during last part of irrigation season; only waste and return waters pass the gage at that time.

REGULATION.—Natural flow affected by the diversions above station.

COOPERATION.—Since January 1, 1911, records have been furnished by the United States Reclamation Service.

Discharge measurements of Spanish Fork at Lake Shore, Utah, during the year ending Sept. 30, 1916.

[Made by R. M. Adams.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 25	4.08	93	Apr. 27	12.32	737
Mar. 29	7.82	355	May 22	4.78	135

Daily discharge, in second-feet, of Spanish Fork at Lake Shore, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.6	6.0	76.0	59.8	79.0	144	317	480	4.5	2.0	1.0	0.0
2	2.6	6.0	79.0	61.4	77.0	119	369	425	21.0	2.0	1.0	0.0
3	2.6	6.0	82.0	68.0	78.0	95	393	472	17.5	2.0	1.0	0.0
4	2.6	6.0	79.4	57.6	80.0	122	438	417	4.5	2.0	1.0	0.0
5	2.6	6.0	76.4	52.5	88.0	144	435	464	2.0	2.0	0.7	0.0
6	2.6	11.6	74.0	47.5	96.0	167	393	502	2.0	2.0	0.3	0.0
7	2.6	17.3	75.0	45.5	104	167	365	528	2.0	2.0	0.0	0.0
8	2.6	23.0	76.0	59.0	107	122	381	569	2.0	1.7	0.0	0.0
9	2.6	23.0	73.5	72.5	110	179	421	546	2.0	1.3	0.0	0.3
10	2.6	23.0	71.0	86.0	112	236	476	582	2.0	1.0	0.0	0.7
11	2.6	28.0	76.5	80.0	113	251	645	524	2.0	1.0	0.0	1.0
12	2.6	33.0	82.0	74.0	113	251	591	451	2.0	1.0	0.0	1.0
13	2.6	42.0	80.0	75.5	113	293	560	389	2.0	1.5	0.0	1.0
14	2.6	51.0	78.0	77.0	113	274	555	317	2.0	2.0	0.0	1.0
15	2.6	60.0	76.0	71.8	113	254	609	277	2.0	1.7	0.0	1.0
16	2.6	60.0	75.0	66.7	113	243	645	229	2.0	1.3	0.0	1.3
17	2.6	60.0	74.0	61.5	116	277	698	174	2.0	1.0	2.3	1.7
18	2.6	62.5	74.7	67.7	119	337	703	122	2.0	1.0	4.5	2.0
19	2.6	65.0	75.2	74.0	119	349	663	119	2.0	1.0	3.0	2.0
20	2.6	65.0	76.0	64.4	119	472	564	151	2.0	1.0	1.5	2.0
21	2.6	65.0	79.0	55.2	119	627	537	232	2.0	1.0	0.0	2.0
22	2.6	65.0	82.0	63.5	120	672	519	128	2.0	1.0	0.0	2.0
23	2.5	65.0	73.5	71.7	122	560	573	122	2.0	1.0	0.0	2.0
24	2.4	65.0	65.0	89.0	123	528	645	116	2.0	1.0	0.0	2.0
25	2.3	65.0	60.0	86.0	125	381	707	101	2.0	1.0	0.0	2.0
26	2.5	65.0	55.0	92.0	123	381	725	89	2.0	1.0	0.0	2.0
27	2.6	65.0	50.0	86.0	121	385	757	86	2.0	2.1	0.0	2.0
28	2.6	65.0	52.5	80.0	119	409	779	33.5	2.0	3.3	0.0	2.0
29	2.6	65.0	55.0	80.0	131	393	792	27.0	2.0	2.5	0.0	2.0
30	3.7	70.5	56.6	80.0	....	345	627	21.0	2.0	1.7	0.0	2.0
31	4.1	....	58.2	80.0	....	321	....	17.5	....	1.0	0.0	....

NOTE.—Discharge for Dec. 30 and 31 interpolated by United States Geological Survey.

Monthly discharge of Spanish Fork at Lake Shore, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4.1	2.3	2.66	164
November	70.5	6.0	43.7	2,600
December	82.0	50.0	71.5	4,400
January	92.0	45.5	70.1	4,310
February	131	77.0	110	6,330
March	672	95.0	306	18,800
April	792	317	563	33,500
May	582	17.5	281	17,300
June	21.0	2.0	3.32	198
July	3.3	1.0	1.52	93.5
August	4.5	0	.526	32.3
September	2.0	0	1.17	69.6
The year	792	0	121	87,800

NOTE.—Monthly discharge computed by United States Geological Survey.

DIAMOND FORK NEAR THISTLE, UTAH.

LOCATION.—In NE. ¼ SE. ¼ sec. 17, T. 9 S., R. 4 E., at foot bridge about 200 yards above mouth, 2½ miles from Thistle, Utah County.

DRAINAGE AREA.—157 square miles.

RECORDS AVAILABLE.—December 2, 1907, to September 30, 1916.

GAGE.—Inclined staff on left bank about 5 feet above footbridge.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

Channel and control.—Bed composed of small gravel; shifts. One channel at all stages; straight for 100 feet above and below gage. Banks covered with cottonwood trees; subject to overflow during extreme floods.

Extremes of discharge.—Maximum stage recorded during year, 5.08 feet May 7 (discharge, 457 second-feet); minimum stage, 2.74 feet January 21 (discharge, 4.2 second-feet).

1907–1916: Maximum discharge, 735 second-feet May 9, 1909 (stage, 5.5 feet). Minimum discharge occurred in 1916, see preceding paragraph.

Ice.—Stage-discharge relation slightly affected by ice for short periods.

Diversions.—No diversions of importance.

Regulation.—Natural flow affected by water supplied from the Strawberry reservoir.

Cooperation.—Since January 1, 1911, all records have been furnished by the United States Reclamation Service.

Discharge measurements of Diamond Fork near Thistle, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 31	R. M. Adams	2.90	9	July 23	R. M. Adams	4.68	188
May 5	.....do	4.90	368	Aug. 11	Jones and Saxton	4.32	121
23	.....do	4.45	186	14	Adams and Saxton	4.45	158
26	.....do	4.32	156	23	.....do	4.58	166
June 10	McGrath and Saxton	4.76	232	30	Adams and Jones	4.60	170
23	Adams and Saxton	4.72	234	Sept. 12	.....do	4.65	170
July 4	.....do	4.30	137				

Daily discharge, in second-feet, of Diamond Fork near Thistle, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26.3	24.2	26.3	7.5	9.0	17.7	90	255	142	270	167	173
2	26.3	24.2	25.6	7.5	7.2	17.7	104	244	128	272	160	173
3	26.3	24.2	26.3	11.4	10.5	17.7	146	252	128	136	157	116
4	26.3	24.2	24.9	9.0	11.7	16.8	128	319	146	132	142	114
4	27.0	24.2	26.3	9.6	10.8	26.0	103	400	137	274	138	114
6	27.0	24.9	25.6	9.9	11.7	18.4	88	427	139	268	440	114
7	27.0	34.0	25.6	6.6	14.1	18.8	94	457	130	266	154	113
8	26.3	26.3	24.2	8.7	15.3	20.0	130	447	128	309	162	172
9	26.3	28.4	24.9	11.7	16.2	25.5	140	432	205	303	156	172
10	26.3	27.0	25.6	11.7	16.2	27.0	236	374	225	314	158	171
11	26.3	26.3	24.2	7.2	16.2	32.6	192	323	224	344	155	171
12	26.3	28.4	24.9	6.9	15.6	42.0	164	302	220	345	153	173
13	27.0	27.0	24.2	9.6	16.2	42.0	156	290	220	346	156	171
14	26.3	27.7	29.8	9.9	16.2	30.5	183	259	220	347	157	146
15	27.0	27.7	29.8	9.3	16.5	30.5	226	230	218	348	147	146
16	27.0	27.0	29.8	10.5	17.1	40.4	244	208	233	349	152	146
17	27.0	26.3	22.8	10.5	15.6	48.4	282	192	233	269	156	143
18	26.3	27.0	16.5	5.7	16.5	44.4	219	205	233	253	159	143
19	26.3	26.3	13.0	6.0	16.5	108.0	177	208	233	243	162	143
20	27.0	27.0	12.4	6.0	16.5	61.0	174	190	250	227	156	168
21	26.3	27.0	18.6	4.2	16.8	183.0	133	186	250	217	156	180
22	26.3	27.0	20.7	6.0	17.1	159.0	151	183	248	216	157	180
23	26.3	26.3	23.5	5.7	17.4	192.0	186	192	241	215	170	180
24	25.6	27.0	18.6	6.0	16.8	70.0	244	202	239	213	173	173
25	25.6	27.0	18.6	12.0	16.8	77.0	290	164	246	212	173	168
26	25.6	27.0	20.0	12.0	17.7	74.0	379	149	242	211	173	168
27	25.6	25.6	13.0	12.0	18.8	95.0	381	149	270	188	173	180
28	25.6	18.6	16.5	9.0	17.7	90.0	379	149	261	186	173	180
29	24.9	30.5	13.0	9.0	16.8	70.1	374	146	256	182	173	180
30	24.9	26.3	10.0	9.0	....	64.9	302	142	270	161	173	163
31	24.9	....	7.6	9.0	....	63.6	....	142	....	158	173	....

Monthly discharge of Diamond Fork near Thistle, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	27.0	24.9	26.2	1,610
November	34.0	18.6	26.5	1,580
December	29.8	7.6	21.4	1,320
January	12.0	4.2	8.68	534
February	18.8	7.2	15.2	874
March	192	16.8	59.1	3,630
April	381	88	203	12,100
May	457	142	252	15,500
June	270	128	210	12,500
July	349	132	251	15,400
August	440	138	169	10,400
September	180	113	158	9,400
The year	457	4.2	117	84,800

Note.—Monthly discharge computed by United States Geological Survey.

UNITED STATES RECLAMATION SERVICE POWER CANAL NEAR SPANISH FORK, UTAH.

Location.—In the SW. ¼ sec. 2, T. 9 S., R. 3 E., near mouth of canyon, half a mile below canal headgates, about 5 miles southeast of Spanish Fork, Utah County.

Records available.—January 1, 1909, to September 30, 1916.

Gage.—Inclined staff on right bank graduated to tenths from zero to 5 feet.

Discharge measurements.—Made from footbridge or by wading at gage.

Channel and control.—Concrete-lined section; bottom width 4.0 feet, side slopes 1 to 1, and maximum depth of water will be about 6 feet. Control not permanent owing to earth and rock slides below the gage.

Extremes of discharge.—Maximum stage reported during year, 4.84 feet, June 11 (discharge 260 second-feet); minimum stage, canal dry for a few days in March and April.

1909–1916: Maximum stage occurred in 1916; see preceding paragraph. Canal dry at times for cleaning and repairs.

Ice.—State-discharge relation sometimes affected by ice.

Diversions.—None above station.

Regulation.—Flow controlled by headgates half a mile above gage.

Cooperation.—Since January 1, 1911, all records have been furnished by the United States Reclamation Service.

This canal, which is designed for a capacity of 500 second-feet, diverts on the left side of Spanish Fork in the SE. ¼ sec. 2, T. 9 S., R. 3 E. About 3 miles below the head is the fore bay of the power plant. Here part of the water can be carried on in the High Line canal to irrigate lands at the south end of the project and the remainder used to supply the power plant or turned down the wasteway. The tailrace water and that going down the wasteway is used to supply the Salem canal or returned to the river.

Discharge measurements of United States Reclamation Service power canal near Spanish Fork, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 18	R. M. Adams	2.36	55	July 10	E. L. McGrath	4.85	240
Feb. 1	.....do	2.39	55	17	.....do	4.90	234
Apr. 21	.....do	2.73	96	26	Adams and Saxton	4.00	156
29	.....do	3.45	148	Aug. 9	Jones and Saxton	3.85	156
May 9	.....do	4.38	217	15	.....do	3.70	149
24	.....do	4.75	243	22	R. M. Adams	3.64	146
June 8	E. L. McGrath	4.50	224	31	Jones and Saxton	3.70	150
19	Adams and Saxton	4.60	237	Sept. 6	R. M. Adams	3.68	148
July 3	E. L. McGrath	4.60	228	18	.....do	3.53	142
4	.....do	3.55	126	25	.....do	3.70	153
5	.....do	4.55	221				

Daily discharge, in second-feet, of United States Reclamation Service power canal near Spanish Fork, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	67.7	70.2	70.2	60.0	60.2	84.5	75.0	187.5	228	225	137	150
2	70.2	70.2	70.8	66.0	60.5	85.2	0.0	151.0	214	225	143	150
3	70.2	70.2	72.1	64.2	62.8	83.0	84.5	196.0	224	227	136	149
4	70.8	70.2	74.6	64.0	66.0	86.6	0.0	194.8	217	123	184	148
5	71.4	69.0	73.9	65.0	68.0	85.0	0.0	186.5	217	218	132	148
6	70.8	69.6	73.3	65.1	77.5	86.3	0.0	190.0	214	217	143	146
7	70.8	73.9	72.1	58.3	81.0	85.0	0.0	202.5	214	219	126	146
8	70.8	72.7	71.4	54.0	58.0	85.1	102.0	201.0	224	239	129	148
9	70.2	71.4	73.9	72.0	88.5	88.2	0.0	217.0	257	243	160	149
10	69.6	73.9	74.6	65.1	89.0	79.5	143.0	212.0	258	240	155	148
11	67.7	70.2	73.9	59.2	80.0	74.0	0.0	205.0	260	233	153	150
12	67.7	66.5	68.3	59.6	74.8	79.4	0.0	222.0	255	231	156	150
13	69.6	70.2	74.6	63.2	71.8	80.5	0.0	222.0	253	138	158	151
14	70.2	63.0	75.3	64.0	75.5	72.2	0.0	216.0	248	220	148	143
15	71.4	64.2	75.3	65.1	75.9	44.0	89.0	213.0	244	231	147	143
16	72.7	72.7	70.2	65.0	76.0	0.0	89.8	221.0	244	226	148	142
17	72.7	71.4	65.9	65.7	61.8	0.0	93.8	220.0	242	235	146	142
18	72.1	71.4	56.4	63.2	53.0	66.0	94.5	234.0	235	158	148	142
19	72.1	73.3	40.0	61.8	65.1	0.0	95.0	227.0	233	158	144	147
20	71.4	75.3	64.2	60.0	86.6	74.5	92.4	226.1	233	137	146	151
21	72.1	75.3	63.0	53.5	88.0	0.0	95.0	204.0	229	144	147	152
22	72.1	74.6	67.7	54.3	89.5	0.0	91.0	229.0	227	137	146	153
23	71.4	74.6	73.9	61.0	90.0	78.3	97.5	247.0	221	140	150	152
24	70.8	76.6	71.4	65.8	89.5	52.0	102.0	243.0	220	147	148	150
25	70.2	70.8	69.0	67.0	90.0	77.0	103.0	243.0	220	154	150	153
26	72.1	74.6	69.0	72.2	89.8	0.0	137.0	214.0	216	157	149	152
27	71.4	75.3	48.1	63.2	100.8	86.2	153.0	208.0	221	157	150	158
28	71.4	62.5	59.7	64.2	83.2	0.0	150.0	207.0	220	157	148	154
29	72.1	70.8	54.8	57.8	83.6	0.0	157.0	233.0	223	159	152	150
30	72.1	74.6	56.4	62.7	......	0·0	184.0	243.0	221	157	150	148
31	72.1	......	56.9	59.3	......	0.0	......	243.0	......	142	150	......

Monthly discharge of United States Reclamation Service power canal near Spanish Fork, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	72.7	67.7	70.9	4,360
November	76.6	62.5	71.3	4,240
December	75.3	40.0	67.1	4,130
January	72.2	53.5	62.6	3,850
February	100.8	53.0	77.1	4,430
March	88.2	0	52.5	3,230
April	184	0	74.3	4,420
May	247	151	215	13,200
June	260	214	231	13,700
July	243	123	187	11,500
August	184	126	148	9,100
September	158	142	149	8,870
The year	260	0	117	85,000

NOTE.—Monthly discharge computed by United States Geological Survey.

HOBBLE CREEK NEAR SPRINGVILLE, UTAH.

LOCATION.—In sec. 7, T. 8 S., R. 4 E., about 150 feet below Springville power plant, 1 mile above mouth of canyon, and 4 miles southeast of Springville, Utah County.

DRAINAGE AREA.—120 square miles.

RECORDS AVAILABLE.—March 23, 1904, to December 31, 1916, when station was discontinued.

GAGE.—Vertical staff fastened to large tree on right bank, 75 feet below cable, June 1, 1909, to September 30, 1916; original gage vertical staff about 1,000 feet downstream, installed March 23, 1904, washed out by flood April 2, 1907; temporary gage, vertical staff at same site as original gage, installed June 1, 1907, washed out by flood about May 1, 1909.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of boulders and coarse gravel; fairly permanent. One channel at all stages; banks high and wooded.

Extremes of discharge.—Maximum stage recorded during year, 6.40 feet April 29 (discharge, 824 second-feet); minimum stage, 3.15 feet February 1 (discharge, 17.4 second feet).

1909–1916: Maximum stage April 29, 1916. Minimum discharge, 7 second-feet October 7 and 8, and December 10, 1905.

Ice.—Flow largely from springs. Stage-discharge relation not seriously affected by ice.

Diversions.—The only diversion above the station is the power canal and this water is returned to the stream about 150 feet above gage.

Regulation.—Low-water flow may be somewhat affected by operation of power plant.

Cooperation.—Since January 1, 1911, all records have been furnished by the United States Reclamation Service.

Discharge measurements of Hobble Creek near Springville, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 3	R. M. Adams	5.30	227	Aug. 21	Jones and Saxton	3.45	25.7
June 26	McGrath and Saxton	3.98	62	Sept. 11	do	3.50	32
July 25	Adams and Saxton	3.60	36.3	Sept. 29	Adams and Saxton	3.35	22.7

Daily discharge, in second-feet, of Hobble Creek near Springville, Utah, for the period Oct. 1, 1915 to Dec. 31, 1916.

Date.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.												
1	25.0	22.8	27.1	22.3	17.4	21.5	254	524	179	71.0	39.5	21.9
2	23.6	22.5	26.4	21.0	18.2	21.5	299	507	179	65.0	39.5	21.5
3	23.6	22.3	25.7	19.8	19.0	21.5	344	494	179	58.9	39.5	21.1
4	23.6	22.3	25.0	20.2	19.8	22.9	389	524	164	50.5	39.5	20.7
5	23.6	22.3	25.0	20.6	20.6	24.3	374	554	179	50.5	39.5	21.1
6	23.6	23.9	25.0	20.3	20.4	25.8	344	569	224	50.5	37.2	21.5
7	23.6	25.5	26.0	20.0	19.8	25.8	299	524	224	53.9	34.8	21.5
8	23.6	27.1	27.1	19.8	20.4	25.8	314	494	224	67.4	34.8	21.5
9	23.6	26.0	26.4	20.2	20.6	34.2	437	554	209	58.9	34.8	21.5
10	23.6	25.0	25.7	20.6	20.6	39.5	560	524	209	50.5	30.2	25.8
11	23.6	26.0	25.0	19.8	20.6	59.0	674	494	209	47.8	25.7	30.0
12	23.6	27.1	25.0	19.0	20.6	90.5	554	464	209	45.0	25.7	27.8
13	23.6	26.4	25.0	19.8	20.6	122	524	404	209	47.8	25.7	25.7
14	23.6	25.7	26.0	20.6	20.6	122	494	374	209	50.5	25.7	24.7
15	23.6	25.0	27.1	20.1	20.6	122	554	359	209	50.5	25.7	23.6
16	23.6	26.0	27.1	19.5	20.6	136	629	194	194	47.8	25.7	22.5
17	23.6	27.1	27.1	19.0	20.6	194	704	136	194	45.0	27.1	21.5
18	23.6	27.1	27.1	19.1	21.0	239	704	254	186	47.8	28.5	21.5
19	22.9	27.1	27.1	19.3	21.5	299	524	254	179	50.5	30.0	21.5
20	22.3	27.1	27.1	19.5	21.5	374	464	254	164	45.0	27.8	22.9
21	22.3	27.1	26.0	19.6	21.5	674	404	246	136	39.5	25.7	24.3
22	22.3	27.1	25.0	19.8	23.6	494	434	239	136	39.5	25.7	25.7
23	22.7	26.0	26.0	20.4	25.8	584	554	224	122	39.5	25.7	24.0
24	23.2	25.0	27.1	20.6	24.4	464	674	224	98	39.5	27.1	22.3
25	23.6	25.7	26.4	20.5	23.0	194	749	209	86	39.5	28.5	20.6
26	24.3	26.4	25.7	20.2	21.5	232	674	209	98	39.5	30.0	20.6
27	25.0	27.1	25.0	19.8	23.6	269	808	179	98	39.5	27.8	20.6
28	24.3	27.1	24.5	19.8	25.8	314	808	179	86	45.0	25.7	20.6
29	23.6	27.1	24.1	19.8	23.6	269	824	179	77	45.0	25.7	20.6
30	23.3	27.1	23.6	19.0	......	224	554	170	77	43.2	25.7	22.3
31	23.1	......	23.6	18.2	......	239	......	179	......	41.4	23.3	......

Daily discharge, in second-feet, of Hobble Creek near Springville, Utah, for the period Oct. 1, 1915, to Dec. 31, 1916—Continued.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1916				1916				1916			
1	24	22	26	11	30	22	24	21	30	26	30
2	26	21	26	12	30	22	26	22	30	26	30
3	28	21	26	13	30	22	24	23	30	26	30
4	30	21	24	14	30	23	23	24	30	26	30
5	28	21	22	15	30	24	22	25	30	26	30
6	26	21	21	16	30	26	24	26	26	26	30
7	27	21	21	17	30	26	26	27	22	26	29
8	29	22	21	18	30	26	28	28	22	26	28
9	30	22	22	19	30	26	30	29	22	26	27
10	30	22	23	20	30	26	30	30	22	26	26
								31	22	......	26

Monthly discharge of Hobble Creek near Springville, Utah, for the period Oct. 1, 1915, to Dec. 31, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16				
October	25.0	22.3	23.5	1,450
November	27.1	22.3	25.7	1,530
December	27.1	23.6	25.8	1,590
January	22.3	18.2	19.9	1,220
February	25.8	17.4	21.3	1,230
March	674	21.5	193	11,900
April	824	254	531	31,600
May	569	136	345	21,200
June	224	77.0	165	9,820
July	71.0	39.5	48.6	2,990
August	39.5	23.3	29.9	1,840
September	30.0	20.6	22.7	1,350
The year	824	17.4	121	87,700
1916				
October	30	22	27.9	1,720
November	26	21	23.9	1,420
December	30	21	26.0	1,600

NOTE.—Monthly discharge computed by United States Geological Survey.

PROVO RIVER AT FORKS, UTAH.

LOCATION.—In NW. ¼ sec. 25, T. 5 S., R. 3 E., half a mile above Vivian Park summer resort, which is just above Forks, Utah County, 2,000 feet below mouth of North Fork of Provo River, which enters on the right, and 3,000 feet above South Fork, which enters on the left, 1 mile above Utah Power & Light Co.'s diversion dam, and 12 miles up Provo Canyon from Provo, on highway and railroad from Provo to Heber.

DRAINAGE AREA.—600 square miles.

RECORDS AVAILABLE.—November 17, 1911, to September 30, 1916. Records have been obtained at various points below the mouth of South Fork since 1890.

GAGE.—Vertical staff on right bank October 5, 1915, to September 30, 1916. Read by J. F. Carter. November 17, 1911, to October 4, 1915, records were obtained from an inclined staff about 2,500 feet downstream.

DISCHARGE MEASUREMENTS.—Made from cable from highway bridge, or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and large boulders; fairly permanent. Banks fairly high and not subject to overflow; one channel at all stages. Well-defined riffle about 80 feet below gage.

Extremes of discharge.—Maximum stage recorded during year, 4.40 feet at 8 a. m. March 21 (discharge, 1,820 second-feet); minimum stage, 0.43 foot at 8 a. m. August 22 (discharge, 208 second-feet).

1911–1916: Maximum discharge, 2,110 second-feet June 8, 1912; minimum discharge, 155 second-feet September 1, 1915.

Ice.—Stage-discharge relation slightly affected by ice.

Diversions.—Station is below diversions for irrigation in Heber Valley and above those in the vicinity of Provo.

Regulation.—A number of small lakes at the headwaters have been utilized as storage reservoirs and flow is regulated to slight extent.

Accuracy.—Stage-discharge relation practically permanent; affected by ice January 1 to February 29. Rating curve fairly well defined between 225 and 1,000 second-feet. Gage read to hundredths once a day. Daily discharge ascertained by applying daily gage height to rating table except for ice-affected period, when a slight correction was made. Records fair.

Discharge measurements of Provo River at Forks, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.
		Lower gage.	Upper gage.	
		Feet.	*Feet.*	*Sec. ft.*
Oct. 5	Stoner and Porter	0.80	0.52	233
Jan. 8	Stoner and Monson	.96	.69	241
Mar. 22	L. C. Monson[a]	2.53	2.48	923
23	A. B. Purton	2.80	2.74	1,070
May 5	L. C. Monson	2.60	2.65	1,030
31	C. C. Jacob	2.48	2.41	927
June 20	Monson and Swendsen[a]	2.36	2.33	968
July 11	C. C. Jacob	1.07	.71	309
Aug. 1	T. F. Wentz[b]	1.00	.58	253
16	C. C. Jacob	.98	.57	239
Sept. 13	H. L. Stoner[a]	.98	.70	280

[a] Employee of Utah Power & Light Co.

[b] Water commissioner, Provo River.

Daily discharge, in second-feet, of Provo River at Forks, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	232	219	297	226	226	315	540	915	957	363	259	272
2	226	211	306	242	262	321	601	814	1,020	346	247	253
3	226	229	312	239	276	279	684	789	864	343	250	253
4	226	211	315	268	288	321	636	789	864	312	247	245
5	232	219	331	262	282	589	605	898	1,010	318	282	247
6	232	213	318	253	288	578	555	1,020	1,160	315	297	247
7	245	256	309	253	291	471	514	1,080	1,150	306	270	250
8	245	245	300	240	291	377	525	1,220	1,080	309	270	242
9	240	229	300	300	279	432	547	1,250	1,100	306	253	265
10	237	250	300	300	282	504	616	1,280	1,180	306	247	337
11	237	242	306	253	279	548	717	1,180	1,150	291	245	306
12	245	245	294	216	279	552	856	1,090	1,100	285	245	297
13	245	237	291	282	253	574	709	999	1,030	282	253	279
14	248	245	300	270	264	559	697	881	1,040	285	237	282
15	248	276	318	262	256	525	709	814	1,040	282	234	285
16	245	282	294	273	256	478	784	688	956	282	242	285
17	259	282	276	245	253	624	847	609	974	291	237	285
18	248	300	259	226	240	697	873	555	898	282	226	282
19	250	306	226	253	256	730	856	544	873	270	221	294
20	245	318	259	259	256	931	747	601	864	256	213	288
21	242	328	306	264	256	1,820	709	578	822	259	210	276
22	237	321	300	309	264	1,140	648	578	789	262	208	270
23	240	312	331	264	264	1,030	652	624	672	262	221	291
24	232	306	331	285	264	923	721	632	593	259	226	265
25	242	300	276	279	267	705	797	601	563	262	247	270
26	242	315	279	273	273	668	931	570	525	262	245	262
27	237	315	253	234	297	640	956	525	436	262	229	253
28	242	265	262	213	303	717	1,070	507	401	309	237	256
29	221	279	282	264	297	640	1,140	589	425	288	240	245
30	215	315	262	237	....	605	1,040	676	333	268	245	245
31	211	....	253	248	....	533	....	839	....	259	270	....

Monthly discharge of Provo River at Forks, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	259	211	238	14,600
November	328	211	269	16,000
December	331	226	292	18,000
January	309	213	258	15,900
February	303	226	270	15,500
March	1,820	279	640	39,400
April	1,140	514	743	44,200
May	1,280	507	798	49,100
June	1,180	363	863	51,400
July	363	256	290	17,800
August	297	208	244	15,000
September	337	242	271	16,100
The year	1,820	208	431	313,000

SOUTH FORK OF PROVO RIVER AT FORKS, UTAH.

Location.—In sec. 26, T. 5 S., R. 3 E., at Vivian Park summer resort, just above Forks, Utah County, about a quarter of a mile above confluence of South Fork with Provo River and 12 miles up Provo Canyon on highway and railroad from Provo to Heber.

Drainage area.—30 square miles.

Records available.—November 17, 1911, to September 30, 1916.

Gage.—Vertical staff nailed to cottonwood tree on right bank June 15, 1913, to September 30, 1916; read by J. F. Carter. Datum raised 2 feet on June 12, 1915. Original gage, vertical staff about 150 feet above mouth of stream, used November 17, 1911, to June 14, 1913.

Discharge measurements.—Made from foot log near gage or by wading.

Channel and control.—Bed composed of gravel; shifting. One channel at all stages; banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 0.76 foot at 9.30 a. m. May 12 and 13 (discharge, 50 second-feet); minimum stage, 0.46 foot at 9.30 a. m. May 29 (discharge 24 second-feet).

1911-1916: Maximum discharge, 74 second-feet, June 10, 1912; minimum discharge, 22 second-feet, May 16, 1915.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Below all diversions.

Regulations.—None.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve poorly defined. Gage read to hundredths once daily. Daily discharge determined by applying daily gage height to rating table. May be subject to error at certain periods due to diurnal fluctuation. Records fair.

Discharge measurements of South Fork of Provo River at Forks, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	Stoner and Porter [a]	0.60	33.3	May 5	L. C. Monson	0.70	55.2
Jan. 8	H. L. Stoner [a]	.58	26.7	June 20	Monson and Swendsen [a]	.68	56.7
Mar. 22	L. C. Monson [a]	.68	47.4	Aug. 1	T. F. Wentz [b]	.50	29.0
23	A. B. Purton	.70	44.5	Sept. 13	H. L. Stoner	.61	37.3

[a] Utah Power & Light Co.

[b] Water commissioner, Provo River.

Daily discharge, in second-feet, of South Fork of Provo River at Forks, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	34	33	36	34	30	28	34	44	28	35	28	35
2	34	33	36	34	30	28	34	44	28	35	29	35
3	36	33	36	34	30	28	34	44	33	34	29	35
4	36	33	34	34	30	31	34	42	28	34	29	35
5	36	33	36	34	30	32	35	42	42	35	30	35
6	36	33	35	33	30	30	34	44	46	35	34	35
7	36	36	36	33	29	30	34	44	44	35	32	35
8	36	36	35	33	28	29	34	44	44	35	32	37
9	36	36	35	34	28	29	35	46	44	35	32	37
10	36	36	34	34	28	29	35	48	44	30	32	38
11	31	34	34	34	28	30	39	48	44	32	32	37
12	32	34	34	34	28	30	39	50	40	32	32	38
13	31	34	34	34	28	30	40	50	40	32	35	38
14	31	33	34	34	28	29	39	48	40	32	35	37
15	31	36	36	34	28	29	38	48	40	35	35	39
16	31	36	34	34	28	29	44	42	40	35	37	39
17	34	36	34	34	28	29	43	42	40	35	35	38
18	34	36	34	34	28	29	43	40	39	35	35	38
19	34	36	34	34	28	30	42	40	39	35	35	38
20	34	36	34	34	28	30	42	39	39	35	35	39
21	34	36	34	34	28	46	42	38	39	34	37	38
22	34	36	34	34	28	42	42	37	39	32	35	39
23	34	36	34	34	28	42	39	37	37	30	36	39
24	33	36	34	32	28	40	39	37	37	32	36	39
25	32	36	34	32	28	40	40	37	37	32	37	39
26	32	36	34	32	28	40	44	37	37	32	37	39
27	33	36	34	32	29	40	44	37	35	29	37	38
28	33	36	34	31	28	37	48	34	35	29	35	42
29	31	36	34	32	28	35	48	24	35	34	35	37
30	32	36	33	32	....	35	46	28	35	30	35	37
31	32	....	34	31	....	34	....	28	....	30	35	....

Monthly discharge of South Fork of Provo River at Forks, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	36	31	33.5	2,060
November	36	33	35.1	2,090
December	36	33	34.5	2,120
January	34	31	33.3	2,050
February	30	28	28.5	1,640
March	46	28	32.9	2,020
April	48	34	39.5	2,350
May	50	24	40.7	2,500
June	46	28	38.3	2,280
July	35	29	33.1	2,040
August	37	28	33.8	2,080
September	42	35	37.5	2,230
The year	50	24	35.1	25,500

SEVIER LAKE BASIN.

MAMMOTH CREEK NEAR HATCH, UTAH.

Location.—In sec. 1, T. 37 S., R. 6 W., about a quarter of a mile above backwater of Hatchtown reservoir, three-quarters of a mile east of east boundary of Sevier National Forest, and 3½ miles southwest of Hatch, Garfield County.

Drainage area.—151 square miles (measured on topographic maps).

Records available.—July 15 to September 20, 1912; May 17, 1913, to August 22, 1914; October 1, 1915, to September 30, 1916; also some miscellaneous measurements in 1911 and spring of 1912.

Gage.—Stevens continuous water-stage recorder on left bank, May 2 to July 3, 1914, and September 23, 1915, to September 30, 1916; original gage, vertical staff on left bank, 1½ miles above present site, in sec. 2, T. 37 S., R. 6 W., July 15 to September 20, 1912, and May 25 to July 11, 1913; Stevens water-stage recorder at site and datum of original gage, July 12, 1913, to April 25, 1914.

Discharge measurements.—Made from cable or by wading.

Channel and control.—One channel at all stages. Control permanent.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.72 feet at 3 a. m. May 12 (discharge, 511 second-feet); minimum stage recorded, 0.92 foot on January 28 and 29 (discharge, 17 second-feet).

1912-1914 and 1916: Maximum stage recorded, 3.78 feet at 7 a. m. and 5 p. m. June 1, 1914 (discharge, 535 second-feet): minimum stage recorded, 0.98 foot July 31, 1913 (discharge, 10 second-feet).

Ice.—Stage-discharge relation seriously affected by ice during most of December, January, and February.

Diversions.—Below all diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Rating curves well defined between 20 and 300 second-feet, and fairly well defined above. Water-stage recorder operated satisfactorily except during winter period and from November 14 to 30, 1915, and July 24 to August 3, 1916. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for periods of defective gage-height record. (See footnote to table of daily discharge.) Records good except for periods mentioned.

Discharge measurements of Mammoth Creek near Hatch, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	J. J. Sanford	1.07	20	May 19	J. J. Sanford	3.42	370
Dec. 11	A. B. Purton	1.28	27.5	June 1	.....do	3.20	309
Feb. 22	J. J. Sanford	1.12	22.8	15	.....do	2.92	256
Apr. 3	.....do	1.48	37	29	.....do	2.36	124
22	.....do	1.96	83	Aug. 20	.....do	1.81	60
May 9	.....do	3.57	480	Sept. 13	.....do	1.52	40.7

Daily discharge, in second-feet, of Mammoth Creek near Hatch, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	32	23	35	......	17	22	36	213	335	109	110	48
2	32	24	......	......	19	22	38	206	345	103	105	47
3	34	21	......	......	20	22	39	213	365	103	105	46
4	35	19	......	......	21	22	41	236	378	101	103	46
5	34	20	......	......	24	24	38	282	389	97	111	44
6	34	26	......	......	25	24	38	361	392	95	116	42
7	34	27	......	......	26	23	37	435	382	92	97	42
8	29	28	......	......	25	22	37	458	375	91	96	43
9	30	29	......	......	25	22	38	473	365	89	92	45
10	30	30	......	......	26	24	41	484	351	84	87	47
11	32	25	29	......	......	26	44	492	328	82	83	45
12	32	25	......	......	......	26	44	492	303	80	78	43
13	30	26	......	......	......	28	42	473	262	78	75	41
14	29	......	......	......	......	30	42	454	260	82	71	41
15	25	......	......	......	......	29	44	421	236	82	69	40
16	26	......	......	......	......	29	50	406	218	82	67	40
17	28	......	......	......	......	30	60	382	204	78	66	41
18	28	......	......	......	......	32	65	385	195	74	64	40
19	28	......	......	......	22	35	65	392	186	72	63	40
20	27	......	......	......	22	38	64	345	182	70	62	39
21	22	......	......	......	23	49	66	300	171	71	59	38
22	22	......	......	......	23	46	77	282	163	70	53	38
23	22	......	......	......	......	50	99	303	154	67	52	39
24	20	......	......	......	......	43	123	310	147	70	51	39
25	21	......	......	......	......	38	152	265	136	80	48	38
26	23	......	......	24	......	36	167	236	117	150	44	38
27	24	......	......	24	......	36	195	254	127	150	44	41
28	25	......	......	17	......	36	241	285	122	120	44	34
29	23	......	......	17	......	36	265	303	123	90	57	47
30	21	......	......	18	......	36	238	342	117	140	67	66
31	22	......	......	20	......	35	......	406	......	110	52	......

NOTE.—No gage-height record, discharge estimated by comparison with record of flow of Sevier River at Hatch, Nov. 14–30, 30 second-feet; Mar. 1–3 and July 24 to Aug. 3, as given in table. Stage-discharge relation affected by ice, discharge estimated by comparison with flow of Sevier River at Hatch: Dec. 2–10, 32 second-feet; Dec. 12–15, 29 second-feet; Dec. 16–31, 38 second-feet; Jan. 1–11, 30 second-feet; Jan. 12–16, 60 second-feet; Jan. 17–25, 26 second-feet; Feb. 11–18, 24 second-feet; Feb. 23–29, 23 second-feet.

Monthly discharge of Mammoth Creek near Hatch, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	35	20	27.5	1,690
November	....	....	27.8	1,650
December	....	....	34.7	2,130
January	....	....	31.7	1,950
February	....	....	23.1	1,330
March	50	22	31.3	1,920
April	265	36	84.2	5,010
May	492	206	351	21,600
June	392	117	248	14,800
July	150	67	92.3	5,680
August	116	44	73.9	4,540
September	66	38	42.6	2,530
The year	492	....	89.3	64,800

SEVIER RIVER AT HATCH, UTAH.

LOCATION.—In SE. ¼ sec. 28, T. 36 S., R. 5 W., at county bridge a quarter of a mile east of J. C. Barnhurst's house at Hatch, Garfield County, and 1½ miles below Hatchtown reservoir.

DRAINAGE AREA.—260 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 3 to November 4, 1911; December 10, 1911, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder 50 feet below bridge, August 23, 1914, to September 30, 1916; inspected by J. C. Barnhurst. Gages previously used as follows: June 3 to November 4, 1911, and December 10, 1911, to May 7, 1912, original gage, about an eighth of a mile upstream from present site; May 8, 1912, to May 6, 1914, vertical staff on middle pier of bridge; Stevens water-stage recorder 1½ miles above bridge, May 7 to May 25, 1914, when Hatchtown reservoir dam broke and released 11,600 acre-feet of stored water. This recorder was reinstalled at old site below bridge August 23, 1914.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; fairly permanent. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.47 feet at 7 a. m. May 10 (discharge, 1,040 second-feet); minimum stage, 0.80 foot November 30, December 1 and 2 (discharge, 80 second-feet).

1911–1916: Maximum stage recorded, 5.8 feet June 5, 1912 (discharge, 1,210 second-feet); minimum stage, 1.0 foot March 18 to April 2, 1912 (discharge, 10 second-feet).

ICE.—Stage-discharge relation affected by ice for short periods.

DIVERSIONS.—Above all diversions except Hatch Bench canal and Panguitch Lake ditch, which divert a small quantity of water from Mammoth Creek. Hillsdale ditch diverts about 4 miles downstream and several other canals about 7 miles below for irrigation in Panguitch Valley.

REGULATION.—Entire flow controlled by gates in Hatchtown reservoir dam before May 25, 1914.

ACCURACY.—Stage-discharge relation subject to change during sudden change in stage of stream; affected by ice during winter. Rating curve well defined. Water-stage recorder not in operation, discharge interpolated, during following periods: October 2–6, January 21–24, February 2–3, and April 23–29. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records good.

Discharge measurements of Sevier River at Hatch, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	J. J. Sanford	0.84	97	May 19	J. J. Sanford	2.84	785
Dec. 11	A. B. Purton	.79	97	June 1	.....do	2.34	588
Jan. 26	J. J. Sanford	.74	89	15	.....do	2.02	476
Feb. 22	.....do	.72	81	29	.....do	1.46	291
Apr. 3	.....do	1.40	280	Aug. 8	.....do	1.34	235
22	.....do	2.20	531	20	.....do	1.13	162
May 9	.....do	3.32	980	Sept. 13	.....do	.97	134

Daily discharge, in second-feet, of Sevier River at Hatch, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	105	105	80	138	165	82	212	737	599	243	329	148
2	106	105	80	122	158	80	236	693	619	236	329	142
3	107	105	90	95	148	85	252	701	623	230	414	140
4	108	105	103	88	140	82	268	737	642	218	297	140
5	109	105	107	87	148	94	252	777	662	212	258	138
6	111	109	109	87	119	92	252	854	677	209	317	133
7	113	131	109	115	90	85	249	924	658	206	243	131
8	109	131	109	113	90	83	255	965	646	204	230	150
9	109	126	107	90	90	83	281	990	646	201	221	148
10	105	126	101	87	90	87	320	1,020	634	195	212	140
11	105	126	95	94	92	94	368	1,010	607	189	204	138
12	105	126	94	236	92	95	351	986	572	189	195	133
13	105	126	95	221	94	99	337	952	523	189	195	133
14	105	122	95	230	101	105	327	903	485	204	187	131
15	101	122	94	230	90	105	351	846	459	204	184	131
16	101	117	126	170	87	109	393	805	433	204	178	128
17	101	117	128	87	88	113	444	761	415	195	173	128
18	101	117	124	90	85	128	468	761	397	192	170	128
19	101	113	122	92	85	140	489	789	380	192	168	131
20	105	113	122	87	82	173	478	749	376	198	170	131
21	105	109	122	87	82	284	496	681	362	206	165	128
22	106	109	122	87	83	300	534	634	354	195	160	128
23	106	105	122	87	83	390	611	634	348	195	152	128
24	106	105	124	87	83	287	689	627	334	192	152	126
25	106	97	124	87	83	258	769	588	320	258	152	124
26	105	97	124	87	82	246	809	530	307	492	150	126
27	105	94	124	87	82	240	891	530	297	395	148	126
28	105	87	124	103	82	236	891	561	278	320	148	128
29	105	83	124	209	82	230	850	580	265	307	178	124
30	105	80	124	145	....	227	842	603	255	497	187	117
31	105	....	122	178	....	206	....	599	....	320	158	....

Monthly discharge of Sevier River at Hatch, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	113	101	105	6,456
November	131	80	110	6,550
December	128	80	111	6,820
January	236	87	123	7,560
February	165	82	99.2	5,710
March	390	80	159	9,780
April	891	212	465	27,700
May	1,020	530	759	46,700
June	677	255	473	28,100
July	497	189	242	14,900
August	414	148	207	12,700
September	150	117	132	7,860
The year	1,020	80	249	181,000

SEVIER RIVER BELOW OLD HOUSTON CANAL, NEAR PANGUITCH, UTAH.

Location.—In the SW. ¼ sec. 4, T. 34 S., R. 5 W., just below heading of Old Houston canal and about 3½ miles north of Panguitch, Garfield County.

Drainage area.—Not measured.

Records available.—August 1 to September 30, 1916, when station was discontinued.

Gage.—Vertical staff on left bank; read by Zera Church.

Discharge measurements.—Made by wading near gage.

Channel and control.—One channel at all stages; fairly permanent.

Diversions.—Numerous diversions for irrigation.

Regulation.—Storage in Panguitch Lake affects the flow at this station to some extent.

ACCURACY.—Stage-discharge relation permanent during period of record. Rating curve not completely defined on account of insufficient discharge measurements. Staff gage read daily except September 13–19, when observer was away from station. Daily discharge ascertained by applying daily gage height to rating table; estimated for days on which gage was not read. Records fair.

Discharge measurements of Sevier River below Old Houston canal, near Panguitch, Utah, during the year ending Sept. 30, 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
June 28		102	Aug. 9	4.30	274
July 11		68	18	4.03	187
25		30	Sept. 12	3.64	86

Daily discharge, in second-feet, of Sevier River below Old Houston canal, near Panguitch, Utah, for the year ending Sept. 30, 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	416	44	11	416	60	21	100	60
2	416	44	12	416	78	22	78	78
3	344	44	13	416	75	23	78	78
4	416	30	14	416	72	24	78	78
5	416	30	15	416	68	25	60	78
						26	60	78
6	416	44	16	380	64	27	44	78
7	494	44	17	308	64	28	44	78
8	416	30	18	176	60	29	44	78
9	380	30	19	148	60	30	44	78
10	416	60	20	100	60	31	44	

NOTE.—Discharge estimated Sept. 13–19.

Monthly discharge of Sevier River below Old Houston canal, near Panguitch, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August	494	44	258	15,900
September	78	30	60.8	3,620

SEVIER RIVER NEAR CIRCLEVILLE, UTAH.

LOCATION.—Approximately in sec. 29, T. 31 S., R. 4 W., 2½ miles above mouth of Pine Creek and 8 miles southwest of Circleville, Piute County.

DRAINAGE AREA.—950 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 10 to September 19, 1912; April 23, 1914, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder, with outside and inside staff gages, about a mile below old gage, April 23, 1914, to September 30, 1916, inspected by James Meeks; vertical staff on bridge abutment during irrigation season of 1912; flow practically the same at both places.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; stream bed is composed of sand and rocks and is fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.0 feet August 6 (discharge estimated 1,600 second-feet); minimum stage, 2.67 feet September 5 (discharge, 88 second-feet).

1912, 1914–16: Maximum stage recorded in 1916; minimum stage, 2.50 feet July 16, 1915 (discharge 65 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Above all diversions for Circle Valley; below several diversions for Hatchtown project and Panguitch Valley.

Regulation.—Flow affected somewhat by operation of Hatchtown reservoir until dam broke May 25, 1914.

Accuracy.—Stage-discharge relation not permanent. Two rating curves used, fairly well defined by frequent measurements—one applicable October 1 to January 29 and the other February 9 to September 30. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph; shifting-control method used January 30 to February 8. Records good.

Discharge measurements of Sevier River near Circleville, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. J. Sanford	2.94	110	May 31	J. J. Sanford	4.44	476
Dec. 7	A. B. Purton	3.26	162	June 15	.....do	3.92	386
Jan. 25	J. J. Sanford	3.26	169	28	.....do	3.14	172
Feb. 21	.....do	3.30	194	July 11	.....do	2.92	120
Mar. 31	.....do	3.78	295	29	.....do	4.30	452
Apr. 21	.....do	4.80	607	31	.....do	6.50	1,110
May 5	.....do	5.05	651	31	.....do	6.50	1,070
7	.....do	5.54	771	Aug. 9	.....do	3.88	333
10	.....do	5.67	867	Sept. 12	.....do	3.10	165
18	.....do	5.08	677				

Daily discharge, in second-feet, of Sevier River near Circleville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	128	122	161	153	140	173	319	804	458	149	426	98
2	120	120	159	207	169	171	342	710	466	149	466	92
3	114	120	161	204	182	166	355	647	469	140	818	92
4	111	120	166	200	169	171	404	635	480	135	691	91
5	106	123	174	170	178	210	402	626	507	135	743	88
6	102	134	170	170	182	247	370	650	507	126	1,250	92
7	94	164	168	150	194	203	342	699	504	124	858	120
8	89	188	170	148	218	195	337	801	493	130	360	121
9	89	295	168	159	238	212	350	828	485	124	342	140
10	90	297	170	164	214	238	386	840	477	135	322	143
11	98	288	170	153	203	243	439	837	477	126	302	142
12	99	164	161	120	210	245	471	837	461	128	295	154
13	95	157	161	125	191	250	444	837	426	121	295	169
14	99	141	163	170	181	254	423	801	390	126	290	158
15	120	157	168	209	185	247	428	768	357	162	268	160
16	111	178	151	190	199	238	461	734	352	203	259	167
17	108	168	142	176	195	238	524	699	314	203	245	167
18	122	163	142	182	199	238	557	664	273	181	234	167
19	123	178	146	190	208	240	580	650	259	164	234	167
20	122	172	144	168	208	259	563	708	245	158	223	171
21	122	170	174	159	210	324	566	650	236	156	199	171
22	111	174	188	142	195	452	583	592	212	160	175	175
23	102	170	194	159	189	458	620	535	201	158	142	175
24	101	164	170	170	187	477	658	535	189	175	133	175
25	105	155	161	166	183	363	708	524	185	364	109	169
26	106	163	159	168	183	373	731	477	181	627	102	167
27	110	172	137	163	193	363	742	452	169	710	102	164
28	120	153	128	168	201	339	786	450	164	741	100	162
29	117	151	161	105	181	337	840	461	166	448	99	166
30	116	161	157	144	......	324	852	463	164	404	108	160
31	117	......	176	136	......	304	......	466	......	781	114	......

Monthly discharge of Sevier River near Circleville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	128	89	109	6,700
November	297	120	169	10,100
December	194	128	162	9,960
January	207	120	164	10,100
February	218	140	193	11,100
March	458	166	276	17,000
April	852	319	519	30,900
May	840	450	657	40,400
June	507	164	342	20,400
July	781	121	247	15,200
August	1,250	99	332	20,400
September	175	88	146	8,690
The year	1,250	88	277	201,000

SEVIER RIVER NEAR KINGSTON, UTAH.

Location.—In NE. ¼ sec. 9, T. 30 S., R. 3 W., just below highway bridge on road from Kingston to Junction, 1¼ miles above mouth of East Fork and 1½ miles northwest of Kingston, Piute County.

Drainage area.—1,110 square miles (measured on topographic maps).

Records available.—June 12, 1914, to September 30, 1916; also several miscellaneous measurements in 1911 published in Water-Supply Paper 310 as "South Fork near Junction, Utah."

Gage.—Stevens continuous water-stage recorder on left bank near bridge, with outside and inside staff gages, August 7, 1914, to September 30, 1916, inspected by W. S. Price; temporary Stevens water-stage recorder 300 feet downstream, June 12 to July 15, 1914.

Discharge measurements.—Made from cable 300 feet below gage or by wading.

Channel and control.—One channel at all stages; stream bed composed of shifting sand and gravel.

Extremes of discharge.—Maximum stage recorded during year, August 6 (discharge estimated 900 second-feet); minimum stage, 2.01 feet at 8 p. m. July 5 (discharge 51 second-feet).

1914–1916: Maximum discharge for period estimated 900 second-feet August 6, 1916; minimum discharge estimated 20 second-feet June 20 to July 1, 1914.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Below all diversions above mouth of East Fork.

Regulation.—Flow affected by diversions for irrigation.

Accuracy.—Stage-discharge relation continually changing, owing to shifting channel and backwater from Piute reservoir. Frequent discharge measurements permit determination of daily discharge with a fair degree of accuracy except for short periods during the winter when the station was affected by ice. A single standard rating curve was used for the entire year. Curves parallel to this were used for various periods, their positions and periods of use being determined from the discharge measurements and field notes. Mean daily gage height determined by inspecting recorder graph. Daily discharge ascertained by applying mean daily gage height to rating tables, by shifting-control method, and by comparison with flow of Sevier River near Junction and East Fork of Sevier River near Kingston, except for periods of ice effect and missing gage-height record, for which it was estimated. (See footnote to table of daily dischage.) Records fair.

Discharge measurements of Sevier River near Kingston, Utah, during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	23	J. J. Sanford	1.50	88	May	20	J. J. Sanford	6.77	618
	28	.....do	1.70	105	June	3	.....do	4.87	337
Dec.	5	A. B. Purton	2.58	208		12	.....do	4.78	330
Jan.	27	J. J. Sanford	2.50	214		26	.....do	2.08	54
Feb.	21	.....do	2.84	248	July	10	.....do	2.11	60
Mar.	30	.....do	3.92	355		30	.....do	5.70	432
Apr.	4	.....do	4.46	390	Aug.	7	.....do	9.40	847
	13	.....do	4.82	445		10	.....do	3.84	334
	20	.....do	5.88	530		21	.....do	2.80	112
May	2	.....do	6.76	648	Sept.	11	.....do	2.78	103
	11	.....do	6.90	629					

Daily discharge, in second-feet, of Sevier River near Kingston, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	68	110	169	175	180	196	320	765	335	60	580	70
2	68	112	167	175	190	193	350	665	335	58	480	68
3	68	114	175	175	200	179	380	568	332	54	590	65
4	68	114	190	190	210	193	414	545	336	51	770	65
5	70	116	206	208	220	239	426	520	366	51	680	60
6	66	142	199	207	220	293	376	580	378	52	900	58
7	65	188	194	187	230	231	350	589	384	60	800	73
8	60	216	188	184	358	198	338	670	366	57	480	85
9	60	208	185	206	366	207	356	690	342	52	417	86
10	65	222	194	208	284	246	394	654	324	57	450	95
11	66	214	192	205	250	263	452	644	336	61	414	101
12	66	190	184	190	246	265	500	645	330	66	384	130
13	65	180	178	190	236	268	446	622	294	63	360	151
14	66	158	181	190	216	278	426	615	276	69	342	137
15	79	167	176	190	210	248	426	615	258	93	294	130
16	101	194	168	205	228	246	459	602	241	135	264	133
17	90	196	153	211	231	249	537	556	202	122	241	142
18	84	192	153	221	230	253	563	511	178	108	208	140
19	91	207	149	243	241	269	570	504	166	106	184	135
20	97	206	137	218	239	307	546	589	149	95	166	135
21	97	207	149	198	242	360	537	561	132	91	124	138
22	97	204	163	190	234	402	555	512	124	91	89	139
23	89	199	171	194	223	400	607	472	114	89	65	141
24	88	200	168	210	216	540	654	441	102	96	64	158
25	87	181	165	216	214	377	676	410	89	161	60	146
26	89	183	161	220	200	364	676	378	68	420	57	140
27	89	190	146	210	223	362	664	350	56	600	60	124
28	105	175	128	224	243	365	666	340	56	600	68	119
29	104	163	151	175	214	362	735	340	57	570	71	109
30	105	173	150	170	......	362	805	335	58	460	77	79
31	105	......	150	170	......	356	......	335	......	510	80	......

NOTE.—Stage-discharge relation affected by ice, Dec. 30 to Jan. 3, Jan. 12–15, Jan. 29 to Feb. 9; gage not operating Apr. 2, 3, and 29, May 23–27, May 29 to June 2, July 26 to Aug. 9, discharge estimated.

Monthly discharge of Sevier River near Kingston, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	105	60	81.2	4,990
November	222	110	177	10,500
December	206	128	169	10,400
January	243	170	199	12,200
February	366	180	234	13,500
March	540	179	293	18,000
April	805	320	507	30,200
May	765	335	535	32,900
June	384	56	226	13,400
July	600	51	166	10,200
August	900	57	315	19,400
September	158	58	112	6,660
The year	900	51	251	182,000

SEVIER RIVER NEAR JUNCTION, UTAH.

Location.—In SE. ¼ sec. 34, T. 29 S., R. 3 W., at Harris's ranch, about a quarter of a mile below junction of East Fork with Sevier River and 1½ miles east of Junction, Piute County.

Drainage area.—2,390 square miles (measured on topographic maps).

Records available.—June 1 to September 2, 1911; May 1, 1912, to December 31, 1916, when station was discontinued.

Gage.—Friez water-stage recorder on left bank, May 20, 1915, to December 31, 1916; June 1 to September 2, 1911, inclined staff on right bank about 500 feet below present site; May 1, 1912, to May 25, 1914, Friez water-stage recorder at site of original gauge; June 20 to August 2, 1914, vertical staff on left bank about 400 feet below present site; August 3, 1914, to May 19, 1915, Friez water-stage recorder at site of vertical staff except August 26 to October 19, 1914, when the recorder was not in operation and readings were secured from the vertical staff.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Stream bed composed of sand and gravel; shifts during high stages; stage-discharge relation affected by backwater from Piute reservoir when full.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 5.48 feet at 2 p. m. August 6 (discharge, determined from extension of rating curve, 1,600 second-feet); minimum stage recorded, 1.12 feet at 7.30 p. m. August 26 (discharge, 38 second-feet).

1911-1916: Maximum discharge occurred when gage was washed out on May 27, 1914, due to the failure of the Hatchtown dam (mean daily discharge estimated, 5,600 second-feet); minimum stage recorded, −0.25 foot, June 3 to 5, 1913 (discharge, 33 second-feet).

Ice.—Stage-discharge relation somewhat affected by ice.

Diversions.—Numerous diversions above station.

Regulation.—Flow controlled to large extent by operation of gates in dam of Otter Creek reservoir on East Fork; before the dam failed, May 25, 1914, by operation of Hatchtown reservoir also.

Accuracy.—Stage-discharge relation variable, owing to changing control and backwater from reservoir; frequent discharge measurements made during the year determine these changes. Three fairly well defined rating curves used. Operation of water-stage recorder satisfactory throughout the year. Daily discharge ascertained by applying to rating table the mean daily gauge height obtained by inspecting recorder graph; several rating tables and shifting-control method used. Records fair.

Discharge measurements of Sevier River near Junction, Utah, during the years ending Sept. 30, 1916 and 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 27	J. J. Sanford	1.24	143	June 15	J. J. Sanford	2.42	237
Dec. 5	A. B. Purton	1.68	281	24	.....do	2.30	213
				26	.....do	2.62	269
1916.				July 10	.....do	2.66	342
Jan. 27	J. J. Sanford	1.58	237	28	.....do	4.56	1,030
Feb. 21	.....do	1.71	276	Aug. 1	.....do	3.83	902
Mar. 29	.....do	2.90	541	10	.....do	3.04	557
Apr. 4	.....do	2.93	522	21	.....do	1.57	115
13	.....do	3.18	580	Sept. 11	.....do	1.50	119
20	.....do	3.60	765	Oct. 9	.....do	3.25	632
May 2	.....do	3.98	949	25	.....do	2.32	304
12	.....do	4.01	909				
20	.....do	3.50	654	1917.			
June 3	.....do	2.90	389	Jan. 12	.....do	1.78	214
12	.....do	2.84	388				

Daily discharge, in second-feet, of Sevier River near Junction, Utah, for the period Oct. 1, 1915, to Nov. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.												
1	78	148	241	200	......	244	430	1,060	367	339	982	76
2	75	143	247	200	......	241	450	952	381	339	928	70
3	80	135	235	200	......	223	477	860	374	336	1,050	80
4	84	135	241	210	......	229	524	820	370	330	1,230	83
5	86	135	289	235	268	277	566	792	402	324	1,140	81
6	90	170	280	235	271	316	514	808	412	318	1,350	74
7	94	198	268	223	340	268	489	884	437	324	1,300	76
8	99	210	247	215	405	250	468	976	437	336	912	87
9	105	220	232	220	405	247	475	972	405	339	676	93
10	96	226	226	229	340	268	514	948	378	345	562	107
11	90	232	232	215	310	283	588	944	342	345	496	116
12	90	223	223	215	304	298	636	916	367	357	458	134
13	90	218	218	220	277	298	580	840	357	357	433	152
14	90	195	226	220	277	331	576	756	330	360	426	143
15	103	208	229	220	277	274	588	728	312	384	388	134
16	129	218	212	230	268	256	620	664	294	437	363	129
17	125	208	200	230	274	265	692	612	243	458	345	136
18	117	205	195	230	271	283	764	559	213	420	317	138
19	117	220	185	230	280	310	784	534	258	367	215	134
20	119	226	170	226	286	358	768	632	252	345	182	134
21	123	229	180	205	277	436	744	618	219	339	136	284
22	123	229	190	195	268	562	764	566	202	327	89	349
23	123	229	200	208	256	668	808	510	208	312	62	360
24	117	229	200	232	256	740	868	479	205	318	53	370
25	117	210	200	241	250	570	920	458	267	378	48	366
26	133	208	190	247	247	540	952	430	270	750	43	366
27	143	223	175	244	262	525	972	381	264	970	42	345
28	145	212	175	253	271	536	988	370	297	1,030	50	338
29	148	212	180	210	262	534	1,040	357	327	1,030	60	326
30	148	235	180	195	......	507	1,090	348	342	814	76	290
31	148	......	180	195	......	446	......	342	......	938	85	......

Day.	Oct.	Nov.	Day.	Oct.	Nov.	Day.	Oct.	Nov.
1916.								
1	329	263	11	576	263	21	311	269
2	380	266	12	472	260	22	310	263
3	458	263	13	447	251	23	310	263
4	506	257	14	440	254	21	309	266
5	360	257	15	412	266	25	308	263
6	489	254	16	374	293	26	305	269
7	1,120	275	17	342	290	27	299	270
8	852	260	18	317	269	28	290	270
9	664	263	19	314	269	29	290	270
10	616	269	20	311	272	30	281	270
						31	272	......

NOTE.—Stage-discharge relation affected by ice and discharge estimated from observer's notes and by comparison with records of discharge at Kingston, as follows: Dec. 20, 1915, to Jan. 4, 1916, Jan. 13-19, and Jan. 31, as in table; Feb. 1-4, 215 second-feet; Dec. 1-8, 260 second-feet; Dec. 9, 250 second-feet; Dec. 10-31, 240 second-feet. Discharge July 26 and Aug. 3, 6, and 7 determined by averaging hourly discharge. Aug. 19-21, one staff-gage reading daily. Discharge interpolated Oct. 22-24 and Nov. 27-30, 1916.

Monthly discharge of Sevier River near Junction, Utah, for the period Oct. 1, 1915, to Dec. 31, 1916.

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Run-off (total in acre-feet).
1915-16.				
October	148	75	110	6,760
November	235	135	203	12,100
December	289	170	214	13,200
January	253	195	220	13,500
February	405	....	278	16,000
March	740	223	374	23,000
April	1,090	430	688	40,900
May	1,060	342	681	41,900
June	437	202	318	18,900
July	1,030	312	463	28,500
August	1,350	42	468	28,800
September	370	70	186	11,100
The year	1,350	42	351	255,000
1916.				
October	1,120	272	421	25,900
November	293	251	266	15,800
December	....	....	a 245	15,100

a Estimated.

PIUTE RESERVOIR NEAR MARYSVALE, UTAH.

Location.—In NW. ¼ sec. 3, T. 29 S., R. 3 W., at Piute dam, 11 miles south of Marysvale, Piute County.

Records available.—March 22, 1914, to September 30, 1916.

Gage.—Iron pins driven every foot into rock face at outlet gates; readings between foot marks are measured with a graduated scale.

Cooperation.—Gage readings and storage table furnished by State engineer of Utah.

Daily storage, in acre-feet, of Piute reservoir near Marysvale, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	9,700	1,700	(a)	6,200	17,200	27,100	37,800	34,500	42,200	36,000	23,400	14,900
2	9,400	1,600	(a)	6,700	17,600	27,400	37,800	34,700	42,400	35,600	23,100	14,900
3	9,300	1,500	(a)	7,100	18,000	27,800	37,900	34,800	42,600	35,400	22,600	14,900
4	8,900	1,400	(a)	7,500	18,400	28,100	37,900	34,700	43,100	34,900	22,300	15,100
5	8,500	1,250	(a)	7,900	18,700	28,400	38,200	34,600	43,600	34,700	21,900	15,300
6	8,400	1,100	(a)	8,200	19,000	28,800	38,400	34,600	44,100	33,700	21,600	15,500
7	8,000	1,050	(a)	8,600	19,300	29,000	38,600	34,700	44,400	33,500	21,200	15,600
8	7,700	1,000	(a)	9,000	19,700	29,300	38,800	34,700	44,600	33,000	20,900	15,600
9	7,400	950	(a)	9,400	20,000	29,600	38,900	34,700	44,800	32,400	20,600	15,700
10	7,100	900	(a)	9,800	20,400	29,900	39,000	34,800	44,800	32,000	20,300	15,800
11	6,800	800	(a)	10,100	20,800	30,200	39,300	34,900	45,000	31,400	20,000	15,800
12	6,600	700	(a)	10,500	21,100	30,500	39,400	35,000	45,100	31,100	19,600	15,800
13	6,200	650	(a)	10,900	21,600	30,800	39,100	35,300	44,800	30,600	19,300	15,700
14	5,800	600	(a)	11,200	21,900	31,100	39,000	35,800	44,500	30,100	18,900	15,700
15	5,500	450	(a)	11,600	22,200	31,600	39,000	36,500	44,200	29,600	18,600	15,700
16	5,300	350	(a)	11,900	22,600	32,000	38,900	37,100	43,800	29,200	18,300	15,600
17	5,100	250	0	12,200	22,800	32,500	38,800	38,100	43,200	28,700	18,000	15,400
18	4,700	200	600	12,600	23,300	33,000	38,600	38,500	42,700	28,100	17,700	15,200
19	4,400	0	1,000	12,800	23,700	33,400	38,400	39,100	42,000	27,800	17,500	15,100
20	4,100	(a)	1,700	13,200	23,900	33,700	38,000	39,700	41,300	27,400	17,100	15,000
21	3,800	(a)	2,000	13,600	24,400	34,100	37,600	40,000	40,500	26,900	16,900	14,900
22	3,500	(a)	2,400	13,800	24,800	34,400	37,500	40,100	39,900	26,500	16,800	14,600
23	3,200	(a)	3,100	14,200	25,100	34,900	37,400	40,400	39,200	26,000	16,500	14,400
24	3,000	(a)	3,400	14,500	25,400	35,200	37,200	40,600	38,700	25,800	16,300	14,200
25	2,800	(a)	3,800	14,800	25,800	35,600	36,900	40,900	38,400	25,500	16,100	13,900
26	2,600	(a)	4,100	15,100	26,100	36,000	36,300	41,000	38,000	25,200	15,900	13,700
27	2,400	(a)	4,100	15,400	26,600	36,300	35,800	41,100	37,600	24,900	15,800	13,500
28	2,300	(a)	4,800	15,700	26,800	36,600	35,200	41,200	37,200	24,600	15,600	13,200
29	2,000	(a)	5,100	16,000	....	37,000	34,600	41,500	36,600	24,600	15,300	12,800
30	1,900	(a)	5,500	16,400	....	37,400	34,400	41,700	36,300	24,300	15,100	12,300
31	1,800	....	6,000	17,000	....	37,700	....	42,000	....	23,900	15,000	....

a Reservoir dry.

Daily storage, in acre-feet, of Piute reservoir near Marysvale, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.												
1	11,400	5,600	13,800	24,600	35,600	46,200	48,900	47,400	38,000	....	28,600	19,400
2	11,400	5,600	14,200	24,900	36,000	46,200	48,800	47,500	38,000	....	29,200	18,600
3	11,000	5,600	14,600	25,200	36,200	46,200	49,400	47,400	38,000	28,400	30,100	17,200
4	10,600	5,600	14,900	25,600	36,500	46,100	50,300	47,000	38,000	28,100	31,300	16,400
5	10,200	5,600	15,400	26,000	36,900	46,200	50,700	47,000	37,800	27,800	32,800	15,700
6	9,900	5,600	15,600	26,500	37,300	46,400	50,500	46,800	37,600	27,400	34,000	14,900
7	9,500	5,600	16,000	26,800	37,700	46,400	50,200	46,400	37,500	27,100	35,200	14,000
8	9,200	5,800	16,400	27,200	38,300	46,300	49,800	46,400	37,200	26,600	35,700	13,200
9	9,900	6,100	....	27,600	38,900	46,300	49,500	46,400	37,100	26,400	35,800	12,600
10	8,600	6,500	17,000	28,000	39,500	46,200	49,100	46,600	36,800	26,000	35,600	11,700
11	8,300	6,800	17,400	28,400	40,000	46,200	49,000	46,600	36,600	25,800	35,300	11,000
12	8,000	7,100	17,600	28,600	40,500	46,200	48,900	46,600	36,500	25,400	35,000	10,200
13	7,700	7,400	18,000	28,900	41,000	46,200	48,800	46,400	36,300	25,100	34,600	9,500
14	7,400	7,500	....	29,100	41,300	46,200	48,500	46,000	36,300	24,900	34,100	8,800
15	7,100	7,900	18,800	29,300	41,700	46,200	48,000	45,600	36,300	24,800	33,700	8,200
16	6,900	8,300	19,200	29,800	42,000	46,300	47,800	45,400	36,000	24,700	33,300	7,300
17	6,700	8,700	19,500	30,200	42,500	46,300	47,600	44,800	35,600	24,600	32,600	6,500
18	6,500	9,100	19,900	30,700	42,800	46,400	47,300	44,400	35,100	24,400	32,000	5,700
19	6,200	9,400	20,200	31,100	43,200	46,400	47,300	43,800	34,700	24,200	31,300	5,100
20	6,100	9,600	20,400	31,600	43,600	46,600	47,400	43,500	34,400	23,900	30,400	4,400
21	6,000	10,000	20,800	31,900	43,900	46,700	47,300	43,000	33,500	23,800	29,600	3,800
22	5,900	10,400	21,100	32,400	44,400	47,200	47,000	42,600	32,800	23,300	28,900	3,300
23	5,800	10,900	21,500	32,600	44,700	47,800	46,900	42,200	32,300	23,000	27,700	3,200
24	5,700	11,200	21,800	33,000	45,100	48,800	46,900	41,600	31,800	22,700	26,600	3,000
25	5,600	11,700	22,200	33,400	45,400	49,100	46,900	41,300	31,300	22,600	25,800	2,700
26	5,600	12,200	22,600	33,800	45,600	49,400	46,800	41,000	30,700	23,900	24,800	2,500
27	5,600	12,500	23,000	34,200	45,800	49,400	46,900	40,500	....	23,800	23,800	2,300
28	5,600	12,800	23,300	34,600	46,100	49,400	46,900	40,000	29,800	25,600	22,800	2,000
29	5,600	13,200	23,700	35,000	46,200	49,300	46,900	39,500	29,600	26,600	22,400	1,900
30	5,600	12,500	24,000	35,200	....	49,200	47,200	39,100	29,400	27,100	21,000	1,800
31	5,600	....	24,300	35,500	....	49,000	....	38,400	....	27,900	20,100	....

SEVIER RIVER BELOW PIUTE DAM, NEAR MARYSVALE, UTAH.

Location.—In sec. 34, T. 28 S., R. 3 W., about 700 yards below dam of Piute reservoir, 11 miles south of Marysvale, Piute County.

Drainage area.—2,440 square miles (measured on topographic maps).

Records available.—May 17 to August 31, 1911; May 1, 1912, to September 30, 1916.

Gage.—Friez water-stage recorder about 500 feet below site of former gage, May 4, 1912, to September 30, 1916; new datum; sloping gage on right bank, May 17 to August 31, 1911.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of sand and loam; one channel at all stages. Control is a riffle of heavy gravel and rocks located at the gage; practically permanent, shifting only slightly during high stages.

Extremes of discharge.—Maximum stage recorded during year, 2.54 feet May 4–5 (discharge, 962 second-feet); minimum discharge recorded December 25–31 (discharge, 29 second-feet).

1911–16: Maximum stage recorded, 3 feet May 27, 1914 (discharge, 1,380 second-feet); minimum stage, −0.52 foot October 25, 1913 (discharge, 2.6 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—No water diverted between this station and that near Junction.

Regulation.—Flow past station entirely controlled by operation of gates in dam above.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Discharge measurements of Sevier River below Piute dam, near Marysvale, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	J. J. Sanford	1.14	191	May 21	J. J. Sanford	2.33	811
Dec. 12	A. B. Purton	.66	85	June 16	.....do	1.77	459
Jan. 29	J. J. Sanford	.14	32.3	17	.....do	1.78	456
Mar. 29	.....do	1.93	529	24	.....do	1.88	547
Apr. 13	.....do	2.08	636	July 29	.....do	2.00	586
20	.....do	2.30	781	Sept. 11	.....do	1.95	559

Daily discharge, in second-feet, of Sevier River below Piute dam, near Marysvale, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	383	194	79	......	238	543	954	573	503	597	603
2	379	194	79	......	238	415	954	435	503	603	591
3	282	194	82	......	241	97	954	374	514	609	585
4	280	194	79	......	238	97	962	411	525	609	579
5	296	194	79	......	238	386	962	486	525	621	573
6	296	194	79	34	238	621	938	520	525	621	561
7	292	194	81	33	272	627	938	508	525	627	573
8	292	164	81	33	309	633	938	503	525	633	591
9	292	137	82	32	313	639	938	503	531	639	579
10	284	137	82	32	313	639	938	498	537	639	567
11	284	137	82	32	313	639	946	470	543	639	561
12	280	137	84	32	313	633	946	445	543	639	573
13	280	119	73	32	313	633	938	392	543	639	561
14	276	100	35	34	317	709	930	330	543	639	555
15	276	99	31	36	317	780	930	388	543	639	579
16	272	99	30	37	317	780	930	455	543	639	597
17	272	99	29	37	317	780	922	465	543	639	579
18	272	99	29	38	322	780	862	503	555	639	567
19	272	100	30	38	322	780	802	503	579	621	591
20	244	100	30	38	322	780	802	520	579	621	609
21	194	100	30	38	322	825	802	525	579	615	585
22	194	76	30	38	322	870	802	520	579	609	567
23	194	38	30	43	326	870	802	514	561	603	555
24	194	38	30	56	352	870	802	514	549	603	537
25	194	38	29	56	392	915	671	508	543	597	525
26	194	38	29	65	435	954	645	508	525	591	519
27	194	51	29	95	498	962	645	508	498	585	503
28	194	68	29	176	543	962	645	503	543	579	498
29	194	79	29	238	543	962	645	503	585	597	492
30	194	79	29	......	543	962	645	503	585	621	486
31	194	......	29	......	543	......	645	......	591	609	......

Note.—No gage-height record Jan. 1 to Feb. 5; reservoir gates closed; leakage past gates and flow past station estimated as follows: Jan. 1–31, 29 second-feet; Feb. 1–5, 31 second-feet.

Monthly discharge of Sevier River below Piute dam, near Marysvale, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (in total acre-feet).
	Maximum.	Minimum.	Mean.	
October	383	194	256	15,700
November	194	38	117	6,960
December	84	29	50.9	3,130
January	....	....	29.0	1,780
February	238	....	51.0	2,930
March	543	238	343	21,100
April	962	97	705	42,000
May	962	645	846	52,000
June	573	330	480	28,600
July	591	498	544	33,400
August	639	579	618	38,000
September	609	486	561	33,400
The year	962	....	384	279,000

SEVIER RIVER AT SEVIER, UTAH.

Location.—In E. ½ sec. 32, T. 25 S., R. 4 W., at Sevier, Sevier County, about 100 yards above railroad bridge on Y spur, 50 yards west of main-line track of Denver & Rio Grande Railroad and 45 yards above mouth of Clear Creek.

Drainage area.—2,700 square miles.

Records available.—May 20, 1911, to September 30, 1916.

Gage.—Friez water-stage recorder on right bank, May 16, 1912, to September 30, 1916; original gage, vertical staff nailed to cottonwood tree, May 20, 1911, to January 7, 1912, when carried out by ice; temporary gage, January 8 to February 23, 1912; inclined staff at same site as Friez water-stage recorder, February 24 to May 15, 1911.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Permanent, except at sudden high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.08 feet from 8 a. m. May 9 to noon May 10 (discharge 1,120 second-feet); minimum stage, 1.35 feet 3 p. m. December 16 (discharge, 32 second-feet).

1911-1916: Maximum stage recorded, 4.7 feet at 6 p. m. June 3, 1914 (discharge, 1,570 second-feet); minimum stage, 1.29 feet October 26, 1913 (discharge, 15 second-feet).

Ice.—Stage-discharge relation affected by ice for short periods.

Diversions.—A few small ditches divert between Piute dam and this station.

Regulation.—Flow past the station practically controlled by operation of gates in Piute reservoir dam, about 27 miles above.

Accuracy.—Stage-discharge relation permanent after the spring floods. Two fairly well-defined rating curves used—one prior to May 17 and the other after May 26. Water-stage recorder operated satisfactorily during the year except for a few days in November, March, and April and during the winter. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records good except for December, January, and February, when stage-discharge relation was affected by ice.

Discharge measurements of Sevier River at Sevier, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	J. J. Sanford	2.32	208	May 17	J. J. Sanford	3.92	1,010
Dec. 3	A. B. Purton	1.85	101	26	.....do	3.50	726
Jan. 21	J. J. Sanford	1.61	62	June 5	.....do	3.22	580
Mar. 9	.....do	2.56	297	10	.....do	3.50	743
25	.....do	2.70	357	22	.....do	3.37	612
25	.....do	2.70	360	July 8	.....do	3.28	598
Apr. 8	.....do	3.24	621	18	.....do	3.21	588
19	.....do	3.57	820	Aug. 15	.....do	3.38	626
29	.....do	3.92	1,030	Sept. 15	.....do	3.21	567

Daily discharge, in second-feet, of Sevier River at Sevier, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	418	212	103	58	......	230	567	1,028	682	577	626	604
2	382	212	103	59	......	233	567	1,010	594	582	632	599
3	382	212	103	61	......	236	314	1,010	487	577	632	594
4	279	212	103	......	68	240	150	1,010	442	594	638	582
5	318	212	103	......	68	247	135	1,016	545	599	643	572
6	313	212	103	......	......	250	393	1,028	643	599	648	566
7	309	212	103	......	......	247	611	1,052	654	599	648	555
8	309	219	103	......	......	290	622	1,076	643	604	643	566
9	298	205	105	......	......	298	622	1,082	665	621	643	566
10	305	183	105	......	......	298	628	1,082	709	610	643	566
11	309	177	105	......	68	298	633	1,082	704	604	643	555
12	309	167	103	......	65	299	638	1,076	670	599	709	572
13	305	157	103	......	62	300	644	1,058	648	588	665	577
14	302	187	91	......	74	301	650	1,058	560	582	665	572
15	305	131	59	......	72	302	725	1,058	525	577	660	560
16	302	127	54	......	71	303	810	1,058	616	577	654	582
17	302	123	......	59	68	304	810	1,022	621	572	648	588
18	298	123	......	54	65	305	812	1,016	604	560	643	588
19	294	123	......	66	62	305	812	950	632	566	643	577
20	294	123	......	......	65	305	812	908	638	572	638	604
21	233	123	......	......	64	305	818	902	654	577	638	599
22	212	122	......	......	62	305	878	896	638	577	632	582
23	205	86	......	......	61	305	902	890	626	577	626	560
24	205	71	......	58	65	305	902	878	621	577	621	555
25	205	70	......	58	77	343	914	794	610	588	616	545
26	202	66	......	58	86	469	968	726	610	594	604	540
27	202	65	......	58	98	450	992	704	610	566	594	535
28	199	82	......	......	116	495	1,016	698	610	560	588	530
29	199	103	......	......	170	520	1,016	692	594	604	582	525
30	199	103	......	......	......	535	1,028	687	582	610	599	520
31	212	......	......	......	......	556	......	682	......	621	610	......

NOTE.—Gage not in operation, discharge estimated Nov. 1-5, 11, 12, 15, 16, 18, 19, Mar. 12-17, Apr. 7, 9-18. Stage-discharge relation affected by ice; discharge estimated as follows: Dec. 17-31, 57 second-feet; Jan. 4-16, 60 second-feet; 20-23, 62 second-feet; 28-31, 60 second-feet; Feb. 1-3, 65 second-feet; 6-10, 67 second-feet.

Monthly discharge of Sevier River at Sevier, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	418	199	277	17,000
November	219	65	146	8,690
December	165	....	77.5	4,770
January	66	....	59.9	3,680
February	170	....	73.7	4,240
March	556	230	326	20,000
April	1,030	135	713	42,400
May	1,080	682	943	58,000
June	704	442	615	36,600
July	621	560	587	36,100
August	709	582	635	39,000
September	604	520	568	33,800
The year	1,080	....	419	304,000

SEVIER RIVER NEAR RICHFIELD, UTAH.

LOCATION.—In sec. 32, T. 23 S., R. 2 W., about 150 feet below Vermilion canal dam and 2 miles east of Richfield, Sevier County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 22 to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on left bank, with inside and outside staff gages.

Discharge measurements.—Made by wading near gage.

Channel and control.—Sand and gravel; subject to change during high stages.

Diversions.—Many irrigation canals divert from river above station.

Regulation.—Flow controlled by reservoirs upstream.

Accuracy.—Stage-discharge relation not permanent. Rating curves fairly well defined. Water-stage recorder gave satisfactory gage-height record during period of record. Daily discharge ascertained by applying to rating tables the mean daily gage height obtained by inspecting recorder graph. Shifting-control method used for periods of shift. Records good.

Discharge measurements of Sevier River near Richfield, Utah, during the year ending Sept. 30, 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
July 20	1.13	6.4	Aug. 14	2.35	90
Aug. 4	1.30	12.3	Sept. 7	1.25	14.8

Daily discharge, in second-feet, of Sevier River near Richfield, Utah, for the year ending Sept. 30, 1916.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	......	14	20	11	......	75	24	21	7	27	28
2	......	14	16	12	......	80	25	22	7	27	29
3	......	13	18	13	......	79	24	23	8	27	32
4	......	13	18	14	......	95	24	24	9	26	38
5	......	24	17	15	......	74	25	25	14	26	34
6	......	50	16	16	......	68	25	26	18	26	31
7	......	66	16	17	......	64	26	27	20	26	31
8	......	67	16	18	......	47	26	28	38	26	34
9	......	71	18	19	......	30	27	29	28	25	36
10	......	64	20	20	7	27	26	30	21	24	36
								31	23	24	......

Note.—No gage-height record; discharge interpolated, Sept. 14–18.

Monthly discharge of Sevier River near Richfield, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July	38	7	16.7	398
August	95	13	42.6	2,620
September	38	16	25.1	1,490
The period	....	....	....	4,510

SEVIER RIVER NEAR VERMILION, UTAH.

Location.—In NE. ¼ sec. 19, T. 22 S., R. 1 W., at highway bridge half a mile below Rockyford dam, 2 miles below Vermilion, Sevier County, and 4 miles above mouth of Lost Creek.

Drainage area.—3,340 square miles (measured on topographic maps).

Records available.—July 15 to September 23, 1912; July 31, 1914, to September 30, 1916.

Gage.—Vertical staff on right bank, July 31, 1914, to September 30, 1916; original gage used in 1912, a quarter of a mile below. Gage reader, Mrs. Will Barron.

Discharge measurements.—Made by wading or from highway bridge.

Channel and control.—Fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 5.40 feet at 8.30 a. m. April 10 (discharge, 560 second-feet); minimum stage recorded, 3.20 feet May 30 to June 3, June 8 to 10, 22 to 28, and July 1 to 23 (discharge, 3 second-feet).

1912, 1914–1916: Maximum stage recorded, 5.50 feet at 5 p. m. November 24, 1915 (discharge, 658 second-feet); minimum stage, 3.10 feet July 9, 10, 28, 31, and August 1, 1915 (discharge, 2 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Entire flow diverted above station during low-water season; discharge record at such times represents seepage and return flow from canals.

Regulation.—Flow past station regulated to a large extent by dams and reservoirs above.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined below 600 second-feet. Staff gage read to hundredths morning and evening each day during the irrigation season and three or four times a week during the rest of the year. Daily discharge ascertained by applying mean daily gage height to rating table; estimated August 29 to September 11, as gage height record was unreliable. Records good for irrigation season except August 29 to September 11.

Discharge measurements of Sevier River near Vermilion, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	J. J. Sanford	4.24	129	May 15	J. J. Sanford	5.08	416
Dec. 14	A. B. Purton	4.40	160	25	.....do	4.78	296
Jan. 22	J. J. Sanford	4.30	148	June 9	.....do	3.16	3.4
Mar. 6	.....do	4.86	296	July 7	.....do	3.20	3.5
28	.....do	5.32	520	Aug. 14	.....do	4.18	114
Apr. 10	.....do	5.36	534	Sept. 9	.....do	3.92	60
18	.....do	5.05	388				

Daily discharge, in second-feet, of Sevier River near Vermilion, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	63	108	157	116	110	175	531	332	3	3	116	54
2	63	108	152	168	116	190	532	332	3	3	116	55
3	72	112	162	143	129	220	533	294	3	3	116	56
4	66	116	173	140	143	250	535	294	63	3	116	57
5	60	125	173	138	148	280	415	222	63	3	116	58
6	63	134	168	173	190	309	415	190	22	3	116	59
7	66	148	168	143	184	314	415	190	27	3	127	60
8	69	148	157	125	196	319	415	352	3	3	138	60
9	60	157	162	148	209	324	460	393	3	3	138	60
10	66	157	168	168	203	352	535	415	3	3	190	78
11	63	152	166	146	162	381	510	415	18	3	176	97
12	66	148	162	125	146	389	510	415	18	3	116	116
13	87	152	162	120	131	394	485	415	27	3	116	116
14	87	148	162	129	116	400	438	415	70	3	116	116
15	98	148	148	125	136	406	332	415	78	3	116	78
16	100	157	143	134	157	406	332	393	78	3	116	78
17	114	160	138	138	146	406	352	372	70	3	106	78
18	134	164	125	138	134	406	372	372	63	3	96	78
19	155	168	82	134	120	406	415	372	63	3	63	78
20	157	203	85	138	123	421	415	372	63	3	63	78
21	162	209	104	148	126	436	393	372	4	3	63	78
22	168	200	120	138	129	451	294	294	3	3	78	78
23	168	190	129	134	126	464	294	294	3	3	78	78
24	148	196	134	138	123	477	294	294	3	4	78	78
25	125	152	129	148	120	490	294	294	3	6	78	78
26	125	152	129	157	124	504	294	294	3	6	50	78
27	116	148	129	162	129	517	294	294	3	6	50	78
28	96	143	116	162	145	530	294	294	3	6	50	78
29	104	152	120	125	160	530	294	256	18	6	58	78
30	104	154	85	138	....	530	294	3	8	116	52	162
31	104	....	116	104	....	530	....	3	....	116	53	....

Monthly discharge of Sevier River near Vermilion, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	168	60	101	6,210
November	209	108	154	9,160
December	173	82	139	8,550
January	173	104	140	8,610
February	209	110	144	8,280
March	530	175	394	24,200
April	535	294	400	23,800
May	415	3	312	19,200
June	78	3	26.4	1,570
July	116	3	10.8	664
August	190	50	98.7	6,070
September	162	54	79.1	4,710
The year	535	3	167	121,000

SEVIER RIVER NEAR GUNNISON, UTAH.

Location.—About 60 rods west of southeast corner of sec. 14, T. 19 S., R. 1 W., near bridge on county road from Gunnison to West View precinct, about 3 miles west of Gunnison, Sanpete County. San Pitch River enters from the east about half a mile below the station.

Drainage area.—3,990 square miles (measured on topographic maps).

Records available.—June 29, 1900, to September 30, 1916.

Gage.—Stevens water-stage recorder on right bank 200 feet below bridge May 19, 1914, to September 30, 1916; vertical staff on right bridge abutment June 29, 1900, to May 18, 1914; datum lowered 1 foot in September, 1910.

Discharge measurements.—Made from cable about 450 feet above gage or by wading.

Channel and control.—One channel at all stages; stream bed composed of fine sand and gravel, shifts at high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.88 feet for 20 hours March 26 (discharge, 915 second-feet); minimum stage, 1.83 feet July 13 and 14 (discharge, 69 second-feet).

1900–1916: Maximum stage recorded, 6.34 feet May 28, 1906 (discharge, 2,240 second-feet); stream dry April 30, 1911.

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—During the irrigation season the greater part of the flow is diverted above the station.

Regulation.—Flow at gage is affected by the operation of the Piute reservoir gates and numerous irrigation diversions above.

Accuracy.—Stage-discharge relation fairly permanent during the year except for a change in April due to shift in control and effect of backwater from San Pitch River during short periods in January and March. Two well-defined rating curves used. Operation of water-stage recorder satisfactory except for periods indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph; shifting-control method used April 4–24. Records good.

Discharge measurements of Sevier River near Gunnison, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	L. W. Jordan	2.36	118	Apr. 3	E. A. Porter	4.67	808
Nov. 4	J. J. Sanford	2.80	210	7	....do	3.51	425
22	L. W. Jordan	3.36	357	18	J. J. Sanford	3.56	490
Dec. 15	A. B. Purton	3.18	313	24	E. A. Porter	3.18	393
Jan. 5	....do	3.20	298	May 12	....do	3.50	508
Feb. 2	J. J. Sanford	3.22	249	June 3	....do	1.97	99
16	....do	3.18	298	Sept. 8	....do	1.99	96
Mar. 19	E. A. Porter	3.92	557	18	J. J. Sanford	2.13	129

Daily discharge, in second-feet, of Sevier River near Gunnison, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	144	195	319	300	248	319	783	411	186	80	101	104
2	142	195	319	300	252	338	822	385	136	80	142	99
3	110	211	319	300	276	350	860	332	93	77	177	97
4	108	213	321	294	305	386	890	382	105	78	160	99
5	120	242	327	308	305	448	680	376	148	77	282	99
6	122	260	327	313	356	502	515	395	158	71	325	97
7	124	308	321	308	368	506	430	407	152	69	237	93
8	127	302	310	296	408	528	512	411	134	75	224	93
9	131	289	313	305	448	547	530	474	118	92	234	104
10	131	291	305	333	455	547	560	558	112	114	237	116
11	133	292	308	338	414	547	563	528	118	109	302	130
12	135	294	305	324	386	548	566	509	112	99	282	120
13	142	295	294	316	347	548	528	517	82	69	224	110
14	158	297	300	308	324	549	518	495	77	69	229	135
15	156	298	308	300	324	549	486	464	105	82	229	125
16	162	300	302	291	313	550	461	453	112	82	260	120
17	173	291	281	291	305	550	455	450	128	71	288	124
18	181	300	260	296	310	550	467	440	128	75	288	130
19	195	347	269	302	300	534	480	404	122	71	229	138
20	228	368	269	296	302	528	492	453	128	69	199	150
21	242	371	269	291	310	537	496	502	122	71	186	156
22	242	359	269	289	327	537	430	440	107	88	170	152
23	240	347	269	286	316	554	412	453	101	88	154	164
24	238	338	269	291	294	625	404	443	103	86	148	190
25	230	330	269	305	289	732	427	440	93	86	132	214
26	209	323	278	273	278	910	443	411	88	95	112	209
27	209	315	280	268	286	830	420	361	85	82	101	206
28	209	308	280	273	300	745	436	370	80	86	101	199
29	206	300	280	265	313	745	467	346	75	82	99	181
30	197	302	280	242	....	745	450	334	75	77	104	188
31	197	....	280	245	....	745	....	258	....	77	104	....

NOTE.—Water-stage recorder not operating Nov. 11-15, Nov. 25-28, Dec. 19-25, Dec. 27-Jan. 2, Jan. 13-15, June 27-July 1, and Sept. 11-15, for which periods daily discharge was estimated by comparison with other stations on the stream. Stage-discharge relation affected by backwater from San Pitch River Mar. 10-17, discharge estimated.

Monthly discharge of Sevier River near Gunnison, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	242	108	172	10,600
November	371	195	296	17,600
December	327	260	294	18,100
January	338	242	295	18,100
February	455	....	326	18,800
March	910	319	569	35,000
April	890	404	533	31,700
May	558	258	427	26,300
June	158	....	113	6,720
July	114	69	81.5	5,010
August	325	101	195	12,000
September	254	93	138	8,210
The year	910	69	287	208,000

SEVIER RIVER AT CLARK'S BRIDGE, NEAR FAYETTE, UTAH.

Location.—In SW. ¼ sec. 13, T. 18 S., R. 1 W., at Clark's bridge, about 1½ miles northwest of Fayette, Sanpete County.

Drainage area.—4,960 square miles (measured on topographic maps).

Records available.—March 17 to September 30, 1914; May 8, 1915, to September 30, 1916, when station was discontinued.

Gage.—May 8, 1915, to September 30, 1916, Stevens water-stage recorder on right bank immediately below bridge. Previous to May 8, 1915, a vertical staff gage fastened to downstream side of right bridge abutment.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—One channel at all stages; stream bed composed of fine gravel, sand, and clay; shifting.

Extremes of discharge.—Maximum stage recorded during year, 5 feet April 4 (discharge, 1,300 second-feet); minimum stage, 1.11 feet July 3 and 4 (discharge, 80 second-feet).

1914–1916: Maximum stage recorded, 6.7 feet June 8, 1914 (discharge, 2,090 second-feet); minimum stage, 0.70 foot July 19, 1915 (discharge, 77 second-feet).

Ice.—Stage-discharge relation affected by ice for short periods in January and February.

Diversions.—Station is below all diversions above Sevier bridge reservoir.

Regulation.—Flow at station affected by operation of Piute reservoir gates and by numerous diversions for irrigation.

Accuracy.—Stage-discharge relation variable. Thirty-two discharge measurements made during the year accurately determine changes in control. Operation of water-stage recorder satisfactory. Daily discharge determined by shifting-control method throughout the year.

Cooperation.—Gage-height record furnished and many discharge measurements made by lower Sevier River water users.

Discharge measurements of Sevier River at Clark's bridge, near Fayette, Utah, during the period Oct. 1, 1915, to Jan. 16, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Oct. 6	L. W. Jordan	1.32	145	June 11	E. A. Porter	1.50	138
Nov. 3	J. J. Sanford	1.86	248	26	.....do	1.30	121
24	L. W. Jordan	2.46	375	July 3	J. W. Thurston	1.15	84
Dec. 15	A. B. Purton	2.40	348	12	E. A. Porter	1.31	140
				Aug. 2	.....do	1.52	179
1916.				6	.....do	2.64	440
Jan. 5	.....do	2.48	360	8	J. W. Thurston	2.07	258
22	R. H. Beckwell	2.42	341	17	E. A. Porter	2.36	344
Feb. 1	J. J. Sanford	3.61	333	21	.....do	1.85	217
1	.....do	3.61	288	27	.....do	1.41	139
17	.....do	2.50	378	Sept. 7	.....do	1.22	113
Mar. 17	E. A. Porter	4.46	1,090	18	J. J. Sanford	1.45	147
Apr. 1	.....do	4.36	1,030	25	E. A. Porter	1.90	232
7	.....do	3.30	580	Oct. 25	.....do	2.90	433
18	J. J. Sanford	3.25	565	Nov. 2	.....do	2.50	339
23	E. A. Porter	2.86	435	21	.....do	4.17	825
May 11	.....do	3.17	547	Dec. 5	.....do	3.75	694
26	.....do	2.89	473	16	.....do	3.49	565
31	.....do	2.18	285				
June 2	.....do	1.72	174	1917.			
4	.....do	1.56	138	Jan. 16	J. J. Sanford	[a]4.50	496

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Sevier River at Clark's bridge, near Fayette, Utah, for the year ending Sept. 30, 1916.

Day.	Nov.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	237	176	348	330	325	402	1,030	437	233	98	130	133
2	240	176	348	331	325	417	1,125	422	151	90	177	131
3	251	129	348	330	325	431	1,220	406	135	90	246	120
4	253	117	373	330	325	466	1,300	394	139	80	218	123
5	259	133	359	376	345	521	1,040	394	171	82	345	123
6	263	141	373	340	402	602	792	408	195	82	417	122
7	337	145	348	352	431	642	592	422	187	85	310	113
8	343	146	335	350	475	619	661	422	167	98	257	115
9	322	142	343	337	505	674	716	466	148	105	280	122
10	324	139	335	364	537	727	716	559	142	135	262	134
11	335	146	343	391	490	843	734	559	133	137	340	146
12	327	156	340	353	460	955	734	559	152	142	314	137
13	337	162	330	343	417	1,060	679	559	119	108	264	126
14	340	161	332	340	375	1,125	661	559	103	103	255	152
15	353	161	345	310	375	1,060	609	527	126	106	248	146
16	348	187	345	316	375	1,090	576	512	144	112	271	146
17	335	199	332	316	375	1,060	543	496	160	96	324	146
18	332	212	314	327	351	727	559	481	165	96	317	146
19	361	222	304	322	351	690	592	466	154	93	265	150
20	400	253	327	324	361	654	592	496	160	90	229	152
21	400	266	312	320	375	690	592	559	160	88	214	162
22	397	273	295	320	375	708	527	496	144	105	208	162
23	375	271	300	310	364	727	466	496	137	108	191	167
24	366	271	312	316	350	823	437	496	139	106	189	191
25	366	271	314	340	356	968	452	496	128	118	181	229
26	340	266	320	377	343	1,240	481	466	120	126	162	240
27	340	262	314	377	356	1,150	452	422	111	126	137	237
28	337	255	372	391	372	1,010	466	408	105	115	128	233
29	324	262	343	350	368	1,010	496	408	98	106	129	212
30	327	248	340	350	....	1,030	496	353	92	105	131	212
31	....	242	330	350	....	1,030	....	310	....	105	129	....

NOTE.—Stage-discharge relation affected by ice Dec. 29 to Jan. 4 and Jan. 29 to Feb. 4. Daily discharge estimated for these periods.

Monthly discharge of Sevier River at Clark's bridge, near Fayette, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	273	117	200	12,300
November	400	237	330	19,600
December	372	295	333	20,500
January	391	310	339	20,800
February	537	....	387	22,300
March	1,240	402	810	49,800
April	1,300	437	668	39,700
May	559	310	466	28,700
June	233	92	145	8,630
July	142	80	104	6,400
August	417	120	233	14,300
September	240	113	158	9,400
The year	1,300	80	348	252,000

SEVIER RIVER AT McARTIE'S FORD, NEAR FAYETTE, UTAH.

LOCATION.—In SE. ¼ sec. 21, T. 17 S., R. 1 W., at entrance to canyon, a third of a mile below return of Fayette canal to river and 7 miles below Fayette, Sanpete County.

DRAINAGE AREA.—5,020 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 4 to December 12, 1914; June 18 to November 3, 1915, when station was discontinued.

GAGE.—Stevens continuous water-stage recorder on right bank, 600 feet below ford, June 22 to November 3, 1915; August 4 to December 12, 1914, McConnell water-stage recorder at same site but referred to a datum 0.07 foot lower.

DISCHARGE MEASUREMENTS.—Made by wading at ford.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; one channel at all stages; shifts occasionally.

Extremes of discharge.—1914–15: Maximum stage recorded, from water-stage recorder, 4.06 feet at 1.45 p. m. December 3, 1915 (discharge, 664 second-feet); minimum stage, 2.08 feet at 3 p. m. July 20, 1916 (discharge, 85 second-feet).

Ice.—Conditions not known.

Diversions.—Below all diversions and tributaries above Sevier bridge reservoir.

Regulation.—Flow at gage is controlled by operation of Piute reservoir gates and numerous irrigation diversions above.

Accuracy.—Stage-discharge relation changed several times. Frequent discharge measurements defined the rating curves fairly well for limited ranges. Operation of water-stage recorder satisfactory except October 22 to November 2, 1915, when clock stopped. Daily discharge ascertained by applying to rating tables the mean daily gage height determined by inspecting recorder graph, except for periods of breaks in gage height record. Records good.

Discharge measurements of Sevier River at McArtie's Ford, near Fayette, Utah, during the period Oct. 1, 1914, to Nov. 3, 1915.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
1914.		*Feet.*	*Sec.-ft.*	1915.		*Feet.*	*Sec.-ft.*
Oct. 7	R. W. Davenport	3.78	496	June 25	J. C. Dort	2.23	99
28	J. J. Sanford	3.64	461	July 9	.....do	2.15	92
Dec. 3	.....do	4.01	648	Aug. 3	.....do	2.16	100
				25	.....do	2.14	97
1915.				31	.....do	2.17	102
Jan. 26	.....do	4.10	298	Sept. 17	.....do	2.50	173
May 14	J. C. Dort	....	265	Oct. 6	L. W. Jordan	2.44	161
June 18	.....do	[a] 2.31	110	Nov. 3	J. J. Sanford	2.80	265
22	.....do	2.25	103				

[a] Gage height of this and following measurements referred to new datum 0.07 foot higher than that of 1914 gage.

Daily discharge, in second-feet, of Sevier River at McArtie's Ford, near Fayette, Utah, for the period Oct. 1, 1914, to Nov. 3, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	419	436	612	......	......	......	94	95	98	175	262
2	391	430	628	......	......	......	96	95	100	173	263
3	402	419	644	......	......	......	97	100	121	166	265
4	444	422	612	......	......	......	95	109	154	147	......
5	472	402	620	......	......	......	94	115	168	153	......
6	489	398	636	......	......	......	92	117	153	163	......
7	510	388	624	......	......	......	92	116	148	168	......
8	538	380	628	......	......	......	92	114	150	168	......
9	534	374	612	......	......	......	93	112	152	170	......
10	530	377	588	......	......	......	92	105	150	168	......
11	538	377	560	......	......	......	90	103	170	170	......
12	522	374	542	......	......	......	89	104	170	175	......
13	510	355	......	......	......	......	88	104	171	178	......
14	496	350	......	......	265	......	89	100	175	191	......
15	492	346	......	......	......	......	89	98	170	191	......
16	492	340	......	......	......	......	89	103	171	193	......
17	492	340	......	......	......	......	89	103	173	204	......
18	506	340	......	......	......	110	90	103	187	208	......
19	503	349	......	......	......	108	90	101	197	216	......
20	496	394	......	......	......	106	86	97	195	236	......
21	475	440	......	......	......	104	86	94	191	245	......
22	468	447	......	......	......	102	89	95	186	247	......
23	472	450	......	......	......	101	92	94	187	248	......
24	475	450	......	......	......	98	97	93	175	250	......
25	464	489	......	......	......	100	106	96	171	251	......
26	464	606	......	298	......	99	114	97	170	253	......
27	464	616	......	......	......	99	105	100	177	254	......
28	461	596	......	......	......	97	105	98	187	256	......
29	440	612	......	......	......	92	98	98	189	257	......
30	440	624	......	......	......	94	94	97	175	259	......
31	440	......	......	......	......	......	94	100	......	260	......

Note.—Discharge interpolated Nov. 14, Dec. 2, and Oct. 22 to Nov. 2, 1915, because of broken gage-height record.

Monthly discharge of Sevier River at McArtie's ford, near Fayette, Utah, for the period Oct. 1, 1914, to Nov. 3, 1915.

Month.	Discharge in second-feet.			Run-off total (in acre-feet).
	Maximum.	Minimum.	Mean.	
1914.				
October	538	391	479	29,500
November	624	340	431	25,600
December 1-12	644	542	609	14,500
1915.				
June 18-30	110	92	101	2,600
July	114	86	93.7	5,760
August	117	93	102	6,270
September	197	98	166	9,880
October	260	147	206	12,700

SEVIER BRIDGE RESERVOIR NEAR JUAB, UTAH.

Location.—In NW. ¼ sec. 1, T. 17 S., R. 2 W., at dam of Consolidated Sevier Bridge Reservoir Co., about 13 miles southwest of Juab, Juab County.

Records available.—January 1, 1914, to September 30, 1916.

Gage.—Inclined staff gage about 100 feet upstream from the south end of the dam since April 26, 1914. January 1 to April 25, 1914, elevations of water surface ascertained by measuring depth of water with a rule at a series of bench marks; these readings were checked at intervals with a wye level.

Cooperation.—Gage-height record furnished by Consolidated Sevier Bridge Reservoir Co.

Daily gage height, in feet, at Sevier bridge reservior near Juab, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	19.30	18.10	28.90	41.80	48.70	55.10				39.35	26.60	16.54
2	19.20	18.05	29.60	42.00				53.15		38.93	26.20	16.40
3	18.90	17.90	30.30	42.20			58.75			38.50	25.80	16.39
4	18.80	17.85	30.90	42.30						38.05	25.45	16.40
5	18.77	17.70	31.60	42.50					47.50	37.77	25.06	16.55
6	18.60	17.60	32.25	42.20	49.65	56.10				37.20	24.75	16.65
7	18.68	17.45	32.85							36.75	24.40	16.66
8	18.75	17.30	33.50					50.90		36.40	24.05	16.66
9	18.75	17.15	34.05							36.00	23.70	16.56
10	18.85	16.99	34.60				58.98			35.55	23.35	16.08
11	18.95	16.98	35.10	43.35	50.90	57.10				35.10	23.00	16.00
12	18.97	16.48	35.60						47.65	34.70	22.60	15.90
13	18.93	15.54	36.10							34.30	22.16	15.80
14	18.93	15.45	36.50							33.80	21.80	15.90
15	18.90	16.20	36.85					48.80		33.36	21.40	16.17
16	18.85	17.10	37.15	44.68	52.00	58.55				32.95	21.05	16.37
17	18.85	18.00	37.55				58.35			32.52	20.70	16.50
18	18.90	18.85	37.95							32.10	20.40	16.70
19	18.85	19.70	38.40						45.61	31.70	20.02	16.95
20	18.85	20.56	38.85							31.25	19.68	17.26
21	18.80	21.30	39.05	45.34	53.20	60.56				30.85	19.25	17.4[illegible]
22	18.80	22.10	39.35					47.20		30.55	18.80	17.4[illegible]
23	18.78	22.90	39.60							30.05	18.55	17.5[illegible]
24	18.65	23.60	39.90				56.60			29.60	17.90	17.3[illegible]
25	18.60	24.41	40.15							29.30	17.75	17.2[illegible]
26	18.55	25.20	40.40	46.92	54.40	59.90			41.80	28.95	17.55	17.0[illegible]
27	18.50	26.00	40.70							28.60	17.35	16.6[illegible]
28	18.45	26.69	41.00							28.25	17.15	16.2[illegible]
29	18.40	27.41	41.20					47.05		27.90	16.97	15.[illegible]
30	18.30	28.20	41.40							27.40	16.76	15.[illegible]
31	18.20		41.60	48.20		58.75				27.00	16.64	

Daily gage height, in feet, at Sevier bridge reservior near Juab, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.												
1				33.20	42.45	50.30				41.30		
2												26.10
3	12.72											
4									51.10			
5			24.20								31.30	
6				35.00	43.70	51.80						
7		14.38						55.80				
8										39.20		
9							60.90					24.40
10	12.30											
11				36.82	45.50	53.80						
12			27.40								30.60	
13												
14		15.25						54.30				
15										36.70		
16				38.20	46.90	56.60	60.70					21.40
17	13.53											
18									45.40			
19			29.75								29.60	
20												
21		17.50		39.60	48.10	58.60		52.50				
22										33.40		
23												17.50
24	14.15											
25												
26			32.10	40.80	49.30	60.30					27.70	
27												
28		21.50						52.50				
29					50.00					31.70		
30							58.70					12.20
31	14.25			42.30		61.00						

SEVIER RIVER NEAR JUAB, UTAH.

Location.—In NE. ¼ sec. 2, T. 17 S., R. 2 W., 1,600 feet downstream from Sevier Bridge dam and 14 miles southwest of Juab, Juab County.

Drainage area.—5,120 square miles (measured on topographic maps).

Records available.—September 23, 1911, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank, 500 feet below old gage, since April 16, 1914; inclined staff on right bank 1,000 feet below Sevier Bridge dam, September 23, 1911, to April 15, 1914.

Discharge measurements.—Made by wading or from cable 600 feet above gage.

Channel and control.—One channel at all stages. Bed composed of sand, clay, and fine gravel. Artificial control of rocks about 40 feet below gage; permanent except during very high stages.

Extremes of discharge.—Maximum stage recorded during year, 5.50 feet at 8 p. m. May 2 (discharge, 1,095 second-feet); minimum stage, 1.26 feet, January 19, 20, 23–27, 30, and 31 (discharge, 7 second-feet).

1911–1916: Maximum stage recorded, 7.8 feet, May 28–29, June 4–12, 1914 (discharge, 2,030 second-feet); minimum discharge recorded, 0.5 second-foot, October 14, 1911.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—None between this station and that near Gunnison.

Regulation.—Flow controlled by gates in dam just above station.

ACCURACY.—Stage-discharge relation permanent except during very high stages. Rating curves well defined by frequent measurements. Gage-height record from water-stage recorder very satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for days of considerable variation for which were used the means of discharge obtained by applying to rating table the hourly gage height, and except for the period April 25–30, for which shifting-control method was used. Records excellent.

COOPERATION.—Gage height record furnished and many discharge measurements made by Lower Sevier River Water Users.

Discharge measurements of Sevier River near Juab, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	L. W. Jordan	1.78	79	June 24	E. A. Porter	3.74	576
Nov. 23	.....do	1.85	96	July 3	J. W. Thurston	3.25	441
Jan. 19	E. A. Porter	1.26	6.8	17	E. A. Porter	3.81	589
23	R. H. Becknell	1.26	6.2	Aug. 1	.....do	2.38	217
Feb. 17	L. W. Jordan	1.27	8.5	8	J. W. Thurston	3.37	475
Mar. 28	E. A. Porter	3.79	576	13	R. H. Becknell	3.11	402
Apr. 12	.....do	4.24	697	Sept. 30	E. A. Porter	3.38	478
May 11	.....do	5.32	1,060				

Daily discharge, in second-feet, of Sevier River near Juab, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	494	253	59	11	8	10	713	1,050	566	358	213	284
2	424	262	61	11	8	10	878	1,080	566	358	220	271
3	424	262	61	10	8	9	940	1,080	610	358	228	271
4	411	265	59	11	8	9	940	1,080	624	440	271	269
5	360	262	61	11	9	9	770	1,070	610	508	358	269
6	146	270	59	11	9	10	713	1,050	624	495	386	271
7	70	270	59	11	12	9	728	1,080	654	482	468	284
8	57	280	59	11	12	9	728	1,080	654	454	482	413
9	91	292	59	12	13	21	728	1,080	654	440	321	413
10	117	315	61	13	12	24	728	1,080	712	440	313	413
11	117	323	61	12	12	23	713	956	770	508	400	426
12	147	334	59	12	12	23	713	956	770	552	400	454
13	171	310	59	11	11	23	713	1,020	800	566	400	482
14	156	331	59	11	11	24	653	988	742	581	400	482
15	147	323	42	11	10	24	551	956	695	581	400	482
16	160	75	19	10	10	18	398	892	725	596	413	482
17	162	230	9	9	8	42	384	830	742	596	440	495
18	166	278	9	8	9	44	411	727	725	596	468	482
19	214	236	9	7	9	44	438	624	712	596	468	482
20	214	180	9	7	9	40	566	495	695	581	482	482
21	226	149	9	8	9	51	580	454	695	538	482	482
22	258	143	9	8	9	33	638	508	668	508	454	523
23	321	95	9	7	9	56	638	495	639	495	440	624
24	341	67	9	7	9	54	713	495	566	495	426	697
25	341	59	10	7	9	56	880	482	552	482	426	668
26	339	53	10	7	9	308	912	440	482	468	413	639
27	336	56	10	7	9	536	945	440	372	256	400	596
28	278	56	10	8	8	580	885	440	305	223	344	538
29	148	56	11	8	9	580	1,050	454	372	220	297	413
30	134	61	11	7	......	594	1,020	468	358	223	292	310
31	231	......	11	7	......	609	......	538	......	211	297	......

Monthly discharge of Sevier River near Juab, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	494	57	232	14,300
November	334	53	205	12,200
December	61	9	33.6	2,070
January	13	7	9.39	577
February	13	8	9.66	556
March	609	9	125	7,690
April	1,050	384	722	43,000
May	1,080	440	787	48,400
June	800	305	623	37,100
July	596	211	458	28,200
August	482	213	381	23,400
September	697	269	447	26,600
The year	1,080	7	336	244,000

SEVIER RIVER NEAR MILLS, UTAH.

Location.—In SW. ¼ sec .36, T. 14 S., R. 3 W., opposite milepost 682 on Los Angeles & Salt Lake Railroad (Lynndyl cut-off), about 7 miles below Mills post office, Juab County.

Drainage area.—5,800 square miles.

Records available.—April 22, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder, with outside and inside staff gages, on left bank 500 feet above railroad bridge.

Discharge measurements.—Made by wading or from cable 100 feet above gage.

Channel and control.—One channel at all stages; stream bed is composed of heavy gravel and rock; permanent.

Extremes of discharge.—Maximum stage recorded during year, 5.74 feet at 7 a. m. April 30 (discharge, 1,070 second-feet); minimum stage 3.14 feet at 2 p. m. January 12 (discharge estimated 36 second-feet).

1914–1916: Maximum stage recorded, 6.71 feet May 27, 1914 (discharge, 1,910 second-feet); minimum stage, 3.14 feet at 2 p. m. January 12, 1916 (discharge estimated 36 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Many diversions above.

Regulation.—Flow affected by operation of several dams and irrigation diversions above.

Accuracy.—Stage-discharge relation permanent. Rating curve very well defined. Gage-height record from water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph; discharge October 1–9, for which there was no gage-height record, estimated by comparison with records of flow at other stations on the river. Records excellent.

Cooperation.—Gage record furnished and some discharge measurements made by lower Sevier River water users.

Discharge measurements of Sevier River near Mills, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	L. W. Jordan	3.93	134	Mar. 29	E. A. Porter	5.08	608
Nov. 29	do	3.72	90	June 29	do	4.64	376
Feb. 16	do	3.48	59	Sept. 9	J. W. Thurston	4.72	420

Daily discharge, in second-feet, of Sevier River near Mills, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	500	268	90	54	61	61	663	1,000	531	415	249	325
2	510	292	90	56	64	60	832	1,040	542	396	249	312
3	455	296	92	57	65	60	925	1,040	542	387	257	304
4	455	304	93	57	67	60	962	1,040	553	382	268	296
5	440	304	92	59	70	65	888	1,000	564	451	347	292
6	395	304	93	60	72	66	755	1,000	564	483	410	292
7	175	316	92	60	73	62	731	1,000	580	483	425	298
8	105	316	92	54	75	61	735	1,000	586	476	526	364
9	95	329	92	64	72	61	735	962	586	446	425	436
10	148	338	93	65	75	66	741	962	592	420	342	425
11	150	356	93	56	64	68	741	962	632	430	374	441
12	153	364	93	49	60	68	735	925	657	483	420	461
13	192	356	93	63	60	68	731	925	682	505	430	478
14	205	351	93	58	60	68	735	925	689	526	430	494
15	185	364	95	57	60	68	645	962	651	537	430	494
16	192	276	86	60	61	68	537	925	695	542	430	488
17	195	172	71	57	64	65	441	867	682	553	425	500
18	195	288	62	49	67	84	441	811	689	559	476	510
19	215	300	52	72	74	89	461	682	689	564	471	500
20	238	257	57	68	78	90	537	564	676	564	483	494
21	231	205	54	56	72	95	609	494	663	548	500	500
22	268	188	54	60	74	98	620	472	663	515	505	488
23	304	145	54	65	70	84	657	494	651	499	488	575
24	347	122	54	60	65	103	663	483	609	488	478	676
25	360	112	53	61	62	103	797	472	586	510	467	702
26	360	100	52	62	61	138	925	467	548	494	451	663
27	356	92	51	57	62	472	925	446	467	436	441	632
28	347	92	56	65	64	586	962	451	387	296	405	603
29	288	90	52	54	62	609	925	451	405	265	360	521
30	140	87	55	63	......	614	1,040	456	420	261	329	420
31	188	......	54	55	......	620	......	488	......	257	325	......

Monthly discharge of Sevier River near Mills, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	510	95	271	16,700
November	364	87	246	14,600
December	93	51	74.3	4,570
January	72	49	59.1	3,640
February	78	60	66.7	3,840
March	620	60	157	9,650
April	1,040	441	736	43,800
May	1,040	446	767	47,200
June	695	387	593	35,300
July	564	257	457	28,100
August	526	249	407	25,000
September	702	288	468	27,700
The year	1,040	49	358	260,000

SEVIER RIVER NEAR LYNNDYL, UTAH.

Location.—In the SE. ¼ sec. 27, T. 15 S., R. 5 W., at homestead of P. J. Flahive, 3½ miles southwest of Lynndyl, Millard County.

Drainage area.—6,270 square miles (measured on topographic maps).

Records available.—April 25, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank, with inside and outside staff gages, 1½ miles below highway bridge.

Discharge measurements.—Made by wading or from cable a quarter of a mile above gage.

Channel and control.—One channel at all stages. Stream bed composed of fine gravel. Control permanent except for very high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 5.47 feet at 5 p. m. May 16 (discharge, 930 second-feet); minimum stage, 1.55 feet at 6 a. m. January 26 (discharge, 21 second-feet).

1914–1916: Maximum discharge recorded June 9, 1914 (discharge, estimated 1,820 second-feet); minimum stage 1.55 feet at 6 a. m. January 26, 1916 (discharge, 21 second-feet).

ICE.—Stage discharge relation affected by ice.

DIVERSIONS.—Numerous diversions above station.

REGULATION.—Flow affected by storage and irrigation diversions above station.

ACCURACY.—Stage-discharge relation subject to slight change during high stages; affected by ice February 20 to March 8. Two well-defined rating curves used. Operation of water-stage recorder satisfactory except for periods covered by footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection. Records February 20 to March 8 roughly approximate; excellent for remainder of year.

COOPERATION.—Gage-height record furnished by Lower Sevier River Water Users.

Discharge measurements of Sevier River near Lynndyl, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	L. W. Jordan	2.19	92	Apr. 11	E. A. Porter	4.46	615
Nov. 29	do	2.22	93	May 25	do	3.71	414
Feb. 16	do	1.74	36.4	June 23	do	4.28	571
Mar. 9	E. A. Porter	1.62	28.3	July 30	do	2.69	184
27	C. C. Jacob	1.84	50	Aug. 13	J. W. Thurston	3.18	295

Daily discharge, in second-feet, of Sevier River near Lynndyl, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	399											
2	4[illegible]	189	91	104	125	28	507	870	373	296	167	225
3	3[illegible]	230	90	94	88	28	563	870	426	252	159	230
4	[illegible]73	252	90	93	74	28	751	900	452	241	167	217
5	[illegible]22	252	128	86	74	28	840	900	452	210	178	210
6	263	252	151	88	68	28	840	900	466	365	184	208
7	220	252	104	86	59	28	736	900	466	375	215	202
8	179	286	104	68	51	28	635	900	488	375	265	204
9	142	274	104	67	57	28	620	900	521	375	370	204
10	109	274	102	90	52	27	620	870	521	360	400	288
11	91	286	71	96	54	32	620	870	535	330	350	305
12	91	298	51	86	39	51	620	840	549	345	200	300
13	103	310	70	70	39	46	620	840	620	410	265	319
14	112	322	84	102	38	34	606	751	650	435	295	319
15	160	310	67	97	51	32	678	870	664	530	298	318
16	179	322	65	80	41	32	620	900	664	465	298	358
17	170	310	63	62	35	30	480	930	650	484	314	355
18	170	189	61	53	33	30	386	870	592	487	317	353
19	170	210	66	45	34	29	335	840	592	495	319	366
20	179	274	75	112	34	34	322	751	620	504	342	366
21	189	263	65	111	32	36	335	606	620	498	337	363
22	210	230	59	130	32	38	426	480	606	490	350	366
23	210	199	60	102	32	36	452	412	592	459	358	366
24	241	189	65	83	32	55	493	412	577	428	360	368
25	274	189	70	42	32	44	535	412	541	400	353	459
26	310	142	135	30	32	44	549	386	501	395	342	565
27	310	128	87	71	32	44	708	360	466	380	332	562
28	322	112	97	210	32	160	766	360	426	310	317	501
29	310	104	106	179	32	373	780	360	399	230	310	436
30	286	97	106	151	32	466	780	360	373	202	281	431
31	230	96	127	125	......	480	810	348	335	184	213	345
	130	......	112	102	......	493	......	348	......	182	228	......

NOTE.—Daily discharge for Feb. 20–Mar. 8, July 4–14, 24–28, and Aug. 7–12 estimated by comparison with records obtained at other gaging stations on the stream. Water-stage recorder was not operating during these intervals.

Monthly discharge of Sevier River near Lynndyl, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	426	91	222	13,600
November	322	96	228	13,600
December	151	51	87.9	5,400
January	210	30	94.0	5,780
February	125	....	47.1	2,710
March	493	....	92.6	5,690
April	840	322	601	35,800
May	930	348	688	42,300
June	664	335	525	31,200
July	530	182	372	22,900
August	....	159	288	17,700
September	565	202	338	20,100
The year	930	....	299	217,000

DELTA AND MELVILLE RESERVOIR NEAR DELTA, UTAH.

Location.—In SE. ¼ sec. 26, T. 16 S., R. 6 W., at south end of diversion dam at head of canal A, about 8 miles northeast of Delta, Millard County.

Records available.—Irrigation seasons of 1914, 1915, and 1916.

Gage.—Inclined staff. Zero of gage is level with bottom of headgates in Canal A.

Daily gage height, in feet, of Delta and Melville reservoir near Delta, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							1915.						
1	(a)	5.40	5.44	5.56	5.22	3.92	16	3.22	5.03	5.40	5.50	4.00	5.30
2	(a)	5.59	5.21	5.42	5.18	3.99	17	3.35	4.98	5.63	5.49	3.98	4.96
3	(a)	5.55	5.20	5.47	5.08	4.14	18	3.40	5.14	5.58	5.42	3.84	4.60
4	(a)	5.49	5.22	5.50	4.95	4.50	19	3.40	5.28	5.47	5.43	3.72	4.30
5	(a)	5.48	5.29	5.50	4.95	4.50	20	3.27	5.51	5.44	5.40	3.64	3.98
6	(a)	5.50	5.44	5.58	4.86	4.54	21	3.39	5.49	5.[illegible]4	5.40	3.40	4.09
7	(a)	5.44	5.26	......	4.84	4.62	22	3.45	5.28	5.0[illegible]	5.50	3.16	2.48
8	(a)	5.45	5.21	5.58	4.80	4.65	23	3.46	5.53	5.20	5.48	2.97	2.51
9	0.91	5.56	5.00	5.49	4.77	4.76	24	3.40	5.56	5.33	5.50	2.82	2.05
10	1.94	5.49	4.87	5.49	4.69	4.94	25	3.51	5.54	5.40	5.55	2.67	1.35
11	2.11	5.44	4.74	5.44	4.57	5.22	26	4.10	5.41	5.42	5.[illegible]0	3.17	(a)
12	2.40	5.37	4.57	5.46	4.49	5.48	27	4.76	5.28	5.62	5.[illegible]	2.31	(a)
13	2.62	5.23	4.51	5.42	4.36	5.45	28	4.78	5.46	5.51	5.46	3.45	(a)
14	2.79	5.15	4.71	5.50	4.20	5.39	29	4.82	5.53	5.38	5.38	3.63	(a)
15	3.08	5.04	5.02	5.56	4.09	5.42	30	4.90	5.56	5.56	5.35	3.70	2.03
							31	......	5.55	......	5.28	3.72	......

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1916.				1916.				1916.			
1	4.00	4.15	3.85	11	4.75	4.50	3.20	21	3.60	[illegible].50	3.80
2	4.00	4.20	3.98	12	4.66	4.55	3.16	22	3.45	5.53	3.78
3	4.14	4.30	3.98	13	4.55	4.60	3.28	23	3.13	5.52	3.75
4	4.86	4.40	3.98	14	4.50	4.53	3.30	24	3.00	5.46	3.65
5	4.78	4.35	3.98	15	5.20	4.87	3.39	25	2.85	5.30	3.55
6	4.75	4.30	4.00	16	5.08	5.15	3.45	26	3.04	5.20	3.20
7	4.60	4.35	3.81	17	4.88	5.45	3.70	27	3.50	5.20	2.96
8	4.55	4.49	3.55	18	4.65	5.45	3.60	28	3.70	5.07	2.63
9	4.70	4.49	3.55	19	4.30	5.37	3.80	29	3.98	[illegible].75	1.97
10	4.75	4.49	3.35	20	4.00	5.40	3.86	30	4.02	[illegible].35	(a)
								31	......	[illegible].83	(a)

[a] Below 0 of gage.

SEVIER RIVER NEAR DELTA, UTAH.

Location.—In NW. ¼ sec. 27, T. 16 S., R. 6 W., 1½ miles below Delta spillway and 6½ miles northeast of Delta, Millard County.

Drainage area.—7,380 square miles.

Records available.—May 16 to September 24, 1912; March 1, 1913, to September 30, 1916.

Gage.—Gurley water-stage recorder on left bank at same datum as the inclined staff gage used prior to March 1, 1913.

Discharge measurements.—Made by wading or from cable about 100 feet below gage.

Channel and control.—One channel at all stages. Bed composed of firm clay and hardpan; right bank may be overflowed at extremely high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.22 feet 9 p. m. April 5 (discharge, 880 second-feet); minimum stage, 0.57 foot March 18–23 (discharge, 23 second-feet).

1912–1916: Maximum stage recorded, 6.82 feet May 31, 1914 (discharge, 1,470 second-feet); minimum mean daily discharge, 15 second-feet July 26, 1914.

Ice.—Stage-discharge relation at times affected by ice.

Diversion.—Canal A of the Delta project takes out water 1½ miles above station.

Regulation.—Flow at station controlled by regulation of the Delta spillway and Sevier Bridge reservoir.

Accuracy.—Stage-discharge relation not permanent. Frequent discharge measurements define the rating. Several well-defined rating curves used. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection, except for ice period, and periods of changing control, for which shifting-control method was used. Records excellent.

Cooperation.—Gage-height record furnished and some discharge measurements made by Lower Sevier River Water Users.

Discharge measurements of Sevier River near Delta, Utah, during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	9	L. W. Jordan	1.14	86	May	31	J. W. Thurston	1.59	166
	12	F. W. Cottrell	.45	15.7	June	8	Porter and Thurston	2.18	302
	14	.....do	.24	5.0		9	J. W. Thurston	1.98	257
	18	.....do	.21	4.7		26	.....do	1.48	142
Nov.	5	J. C. Dort	.95	58		30	E. A. Porter	1.92	233
	19	.....do	1.27	98	July	22	.....do	1.18	108
	28	.....do	.92	54		27	.....do	.97	70
Jan.	11	E. A. Porter	1.03	69	Aug.	2	J. W. Thurston	.91	63
Mar.	11	.....do	.72	38		19	E. A. Porter	1.30	124
	25	.....do	.58	20		31	Jacob and Porter	1.04	78
	31	.....do	2.38	326	Sept.	4	E. A. Porter	1.05	82
Apr.	9	.....do	3.14	536		21	.....do	1.24	110
	27	.....do	1.86	220		29	.....do	1.30	121
May	30	.....do	1.50	148		30	Thurston and Porter	1.00	67

Daily discharge, in second-feet, of Sevier River near Delta, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	245	254	60	64	54	37	386	322	163	160	68	115
2	245	118	57	63	54	37	510	346	215	154	60	105
3	240	75	59	63	54	37	525	358	238	156	63	98
4	177	69	68	65	54	35	432	382	240	151	61	93
5	109	61	68	68	51	32	853	395	228	147	70	99
6	113	72	258	68	53	38	760	382	222	147	110	87
7	110	85	336	65	57	35	620	370	255	186	132	92
8	95	86	203	63	58	33	532	382	282	152	144	96
9	65	86	151	63	64	33	546	395	256	151	174	98
10	44	89	123	72	65	32	575	395	254	151	253	105
11	44	89	95	73	63	39	560	395	258	170	217	89
12	38	96	79	69	58	38	532	370	273	148	153	79
13	31	109	84	64	48	26	489	360	273	142	136	89
14	30	117	96	61	48	25	351	365	273	160	132	96
15	29	121	98	64	48	24	382	395	268	186	130	102
16	30	126	82	66	48	24	320	421	213	198	130	98
17	30	118	72	64	48	24	192	462	237	184	124	102
18	29	98	64	57	48	23	126	475	245	174	127	105
19	30	101	57	57	48	23	117	370	256	202	139	113
20	37	121	57	54	48	23	115	233	279	209	130	112
21	50	75	59	54	48	23	124	178	245	196	122	112
22	55	68	63	54	48	23	136	167	215	170	119	107
23	64	63	65	54	48	23	160	149	235	180	122	108
24	60	60	63	54	48	27	184	138	220	190	129	165
25	58	59	63	54	48	31	186	156	192	190	130	329
26	58	58	75	54	48	64	190	147	158	157	129	337
27	59	55	79	54	39	65	201	138	140	82	125	256
28	85	59	65	54	41	130	258	138	134	60	120	120
29	85	60	64	54	39	314	264	134	131	68	117	112
30	72	61	65	54	....	412	269	145	184	64	103	124
31	41	....	65	54	....	361	....	168	....	70	103	....

NOTE.—Discharge estimated Jan. 20 to Feb. 4, and Feb. 13 to 26 on account of ice, by comparison with records of flow at other stations on the stream.

Monthly discharge of Sevier River near Delta, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	245	29	79.3	4,880
November	254	55	90.3	5,370
December	336	57	93.3	5,740
January	73	....	60.5	3,720
February	65	39	50.9	2,930
March	412	23	67.5	4,150
April	853	115	363	21,600
May	475	134	297	18,300
June	279	131	226	13,400
July	209	60	153	9,410
August	253	60	125	7,690
September	337	79	125	7,440
The year	853	23	114	105,000

GUNNISON BEND RESERVOIR NEAR DELTA, UTAH.

LOCATION.—In sec. 15, T. 17 S., R. 7 W., at south corner of reservoir, at head of Deseret canal, about 2 miles west of Delta, Millard County.

RECORDS AVAILABLE.—Irrigation seasons of 1914, 1915, and 1916.

GAGE.—Chain gage established June 19, 1914; readings represent depth of water on gate sill. Depths were measured directly with graduated pole prior to June 19, 1914.

Daily gage height in feet, of Gunnison Bend reservoir for the years ending Sept. 30, 1915 and 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							1916.						
1	......	12.15	12.80	9.50	9.75	8.10	1	10.80	10.00	10.30	11.05	8.98	9.76
2	......	12.40	12.15	9.50	9.70	8.00	2	11.00	10.00	10.05	10.90	8.85	9.73
3	......	12.45	11.95	9.50	9.55	8.00	3	11.10	10.25	9.90	10.75	8.75	9.70
4	......	12.55	11.95	9.45	9.50	8.05	4	11.20	10.35	9.80	10.75	8.68	9.66
5	......	12.50	11.85	9.40	9.40	8.00	5	11.30	10.50	9.75	10.77	8.52	9.65
6	7.80	12.70	11.80	9.45	9.35	8.10	6	11.40	10.60	9.70	10.78	8.40	9.60
7	......	12.70	11.80	9.70	9.20	8.10	7	11.20	10.55	9.60	10.80	8.50	9.60
8	8.70	12.60	11.90	10.10	9.00	8.20	8	11.00	10.55	9.54	10.80	8.58	9.61
9	......	12.40	11.90	10.50	8.90	8.20	9	11.04	10.45	9.60	10.87	8.70	9.62
10	......	12.35	......	10.70	8.75	8.20	10	11.50	10.45	9.55	10.70	9.00	9.70
11	10.65	12.20	......	10.70	8.55	8.30	11	11.60	10.45	9.50	10.50	9.04	9.81
12	10.80	11.80	11.90	10.50	8.50	8.45	12	11.60	10.40	9.50	10.30	9.72	9.86
13	10.90	11.40	11.90	10.30	8.50	8.55	13	11.45	10.50	9.55	10.00	9.80	9.90
14	11.00	11.10	11.90	10.00	8.50	8.80	14	11.50	10.55	9.58	9.91	9.85	9.92
15	11.40	10.70	12.00	9.70	8.35	8.95	15	11.40	10.45	9.60	9.80	......	9.98
16	11.40	10.35	12.00	9.50	8.40	9.10	16	11.75	10.40	9.67	9.80	9.85	10.02
17	11.30	10.00	12.00	9.30	8.40	9.20	17	11.70	11.05	9.72	9.85	9.85	10.05
18	11.30	9.80	12.20	9.30	8.40	9.30	18	11.65	11.40	9.85	9.80	9.90	10.09
19	11.30	9.65	12.05	9.30	8.30	9.40	19	11.70	11.90	10.05	9.82	9.95	10.12
20	11.30	9.60	11.85	9.30	8.25	9.55	20	11.20	12.20	10.20	9.87	9.98	10.22
21	11.20	10.05	11.60	9.30	8.20	9.70	21	10.90	12.10	10.60	9.90	10.03	10.28
22	11.10	11.10	11.45	9.15	8.20	9.80	22	10.70	12.00	10.72	9.90	10.05	10.40
23	11.25	11.80	11.10	9.30	8.20	9.85	23	10.60	11.80	10.95	9.82	10.05	10.45
24	11.25	12.15	11.00	9.40	8.10	......	24	10.45	11.55	11.03	9.80	10.00	10.51
25	11.15	12.75	11.30	9.60	8.10	10.00	25	10.35	11.40	11.30	9.87	9.98	10.78
26	11.00	12.80	11.10	9.70	......	10.10	26	10.35	11.30	11.42	9.90	9.96	10.40
27	11.50	12.70	10.60	9.80	8.20	10.25	27	10.25	11.20	11.50	9.88	9.96	12.01
28	11.75	12.60	10.20	9.90	8.20	10.30	28	10.15	11.05	11.42	9.56	9.90	12.36
29	12.00	12.65	10.00	10.00	8.20	10.45	29	10.05	10.90	11.30	9.40	9.85	12.82
30	12.25	12.90	9.70	10.00	8.25	10.70	30	10.00	10.70	11.12	9.20	9.83	12.32
31	......	12.85	......	9.90	8.10	......	31	......	10.45	......	9.10	9.78	......

SEVIER RIVER AT OASIS, UTAH.

Location.—In E. ½ sec. 33, T. 17 S., R. 7 W., about three-quarters of a mile northwest of Oasis, Millard County, 1½ miles below county bridge, locally known as Hinckley Bridge.

Drainage area.—8,080 square miles (measured on topographic maps).

Records available.—April 13, 1912, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank, April 24, 1914, to September 30, 1916; vertical staff on county bridge, in the SW. ¼ sec. 22, T. 17 S., R. 7 W., April 13, 1913, to April 23, 1914; datum of vertical staff raised 0.15 foot December 19, 1913.

Discharge measurements.—Made from county bridge or by wading.

Channel and control.—Two channels at extreme high water, one channel at low and medium stages. Bed is composed of sand with slight vegetal growth. Control is ordinarily permanent during irrigation season.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 7.20 feet at midnight April 6 (discharge, 720 second-feet); minimum stage 1.50 feet August 8 and September 8 and 9 (discharge, 11 second-feet).

1912–1916: Maximum stage recorded, 9.45 feet June 12, 1914 (discharge, 1,580 second-feet); minimum stage 2.00 feet May 13 to 19, 1912 (discharge, 0.5 second-foot).

Ice.—Stage-discharge relation at times affected by ice.

Diversions.—Numerous diversions above station take practically entire flow during irrigation season; water passing gage at such times is largely seepage or return water entering below Gunnison Bend reservoir.

Regulation.—Flow controlled by storage reservoirs and diversion dams above station.

ACCURACY.—Stage-discharge relation permanent throughout the year. Rating curve well defined. Operation of water-stage recorder satisfactory except for period July 29 to September 20, during which staff gage readings to hundredths once daily were obtained. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records good.

COOPERATION.—Many discharge measurements made by engineers of Lower Sevier River Water Users.

Discharge measurements of Sevier River at Oasis, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 8	L. W. Jordan	1.68	14.7	Mar. 31	E. A. Porter	4.63	311
27	F. W. Cottrell	1.98	28.5	Apr. 8	.....do	5.17	393
Nov. 23	J. C. Dort	1.98	25.8	May 16	.....do	1.89	18.8
Jan. 11	E. A. Porter	2.80	80	June 22	.....do	1.64	15.7
Mar. 10	.....do	2.04	30	Sept. 21	.....do	1.54	11.6

Daily discharge, in second-feet, of Sevier River at Oasis, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	24	26	58	75	45	291	18	15	16	13	12
2	20	30	28	62	74	45	321	18	14	16	13	13
3	22	26	28	66	74	45	431	17	14	16	12	12
4	22	26	30	64	75	45	439	19	14	15	12	12
5	23	27	30	66	74	45	530	18	14	13	12	13
6	25	27	30	80	74	45	667	20	15	13	13	12
7	25	22	31	93	70	45	667	19	17	14	14	13
8	16	22	63	90	72	40	479	24	19	13	11	11
9	17	26	89	87	74	30	415	27	17	13	11	11
10	17	26	95	85	69	30	447	26	19	12	11	12
11	17	27	95	82	75	30	447	26	15	12	12	12
12	17	28	87	79	74	26	463	22	15	12	13	12
13	17	25	78	78	72	26	407	21	15	12	13	12
14	16	17	74	79	70	26	351	20	16	12	12	12
15	16	23	78	74	70	26	190	20	16	12	12	12
16	16	30	78	74	69	26	170	20	16	12	12	12
17	15	28	73	76	66	26	124	20	19	11	11	12
18	17	28	70	75	65	26	48	20	17	11	14	12
19	16	28	54	75	63	26	32	26	17	12	14	12
20	16	27	38	73	63	27	27	72	18	12	14	12
21	17	27	38	68	58	27	28	57	16	12	13	12
22	19	27	47	70	58	28	22	25	16	13	13	13
23	19	28	45	72	58	26	21	24	17	18	14	15
24	16	28	48	70	58	25	21	26	18	15	14	14
25	21	20	51	72	56	25	21	30	19	15	15	15
26	21	19	52	72	56	24	21	26	20	13	14	16
27	22	27	52	72	55	24	20	24	20	14	14	34
28	28	18	54	70	50	25	19	22	19	11	13	35
29	30	20	60	70	47	351	20	18	17	14	13	20
30	30	27	61	74	....	336	17	16	17	11	12	18
31	23	....	62	125	....	314	....	15	....	11	12	....

NOTE.—Gage height not recorded Jan. 31, May 16 and 17, Aug. 3, 4, 6, 9, 10, 14, 23, 24, 27, Sept. 1, and 10 to 20; discharge interpolated.

Monthly discharge of Sevier River at Oasis, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	30	15	19.8	1,220
November	30	17	25.3	1,510
December	95	26	56.3	3,460
January	125	58	75.8	4,660
February	75	47	66.0	3,800
March	351	24	60.8	3,740
April	667	17	238	14,200
May	72	15	24.4	1,500
June	20	14	16.7	994
July	18	11	13.1	805
August	15	11	12.8	786
September	35	11	14.4	858
The year	667	11	51.8	37,500

HATCH BENCH CANAL NEAR HATCH, UTAH.

Location.—In NW. ¼ sec. 1, T. 37 S., R. 6 W., about half a mile below head of canal and 3½ miles southwest of Hatch, Garfield County, on road to sawmill.

Records available.—May 15 to September 30, 1914; May 1 to September 30, 1916; discharge measurements in 1915.

Gage.—Vertical staff nailed to side of wooden flume just below waste gate.

Discharge measurements.—Made by wading about 100 feet below gage.

Channel and control.—Rectangular flume section, 4 feet wide at gage. Permanent control is afforded by free fall at lower end of flume.

Diversions.—None; this is the only diversion of any importance from Mammoth Creek above the gaging station, except the one at Panguitch Lake.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve fairly well defined. Gage read to hundredths once a week. Discharge for days when gage was read determined by applying gage height to rating table; discharge for intermediate periods obtained by interpolation; and monthly discharge determined by taking mean for the month. Determinations of monthly discharge roughly approximate only, owing to infrequent gage readings. No record of gage height available for 1915.

Canal diverts water from Mammoth Creek, probably in sec. 3, T. 37 S., R. 6 W. The water is used for irrigation in the vicinity of Hatch.

Discharge measurements of Hatch Bench canal near Hatch, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
July 28	0.92	13.4	May 19	0.96	13.9	Aug. 20	0.32	3.0
Aug. 24	.85	14.2	June 1	1.06	16.8	Sept. 13	.80	10.2
			29	1.02	16.4			

Monthly discharge of Hatch Bench canal near Hatch, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
May	14.3	880
June	16.8	1,000
July	13.3	820
August	2.6	160
September	10.0	590

STATE CANAL NEAR PANGUITCH, UTAH.

Location.—In NW. ¼ sec. 2, T. 35 S., R. 5 W., about three-quarters of a mile below head of canal and 3½ miles southeast of Panguitch, Garfield County.

Records available.—May 3, 1913, to September 30, 1916, during irrigation seasons only.

Gage.—Stevens continuous water-stage recorder on right bank at upper end of flume. Gage used May 3 to September 30, 1913, was a vertical staff nailed to right side of flume 15 feet from north or lower end. Zero of gage is grade of flume.

Discharge measurements.—Made by wading or from plank across flume.

Channel and control.—Wooden flume section. Canal bed above and below flume composed of clean gravel. Grade of flume about 0.4 foot below that of canal. Concrete cut-off wall at head of flume serves as control.

Diversions.—None above station.

Regulation.—Flow controlled by headgates.

Accuracy.—Stage-discharge relation changed frequently during 1915; three fairly well definied rating curves used; permanent during 1916; one fairly well defined curve. Operation of water-stage recorder satisfactory except for a few short breaks in record. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for days of considerable variation, for which were used mean discharge obtained by applying to rating table the hourly gage height. Records good.

Records indicate amount of water diverted from Sevier River for the Hatchtown project of the Utah State Land Board. Canal diverts water from Sevier River in sec. 14, T. 35 S., R. 5 W. The water is used for irrigation in vicinity of Panguitch.

Discharge measurements of State canal near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 18	J. J. Sanford	0.94	24	May 5	J. J. Sanford	1.13	28.5
30	do	1.12	29.6	19	do	1.52	41.5
June 15	do	1.54	50	June 1	do	1.54	47.3
July 2	Sanford and Jones	1.70	56	14	do	1.72	53
15	Porter, Sanford, and Jones.	1.56	46	29	do	1.82	63
				July 12	do	1.64	52
Aug. 11	J. J. Sanford	1.00	21	Aug. 20	do	.38	2.5
24	Sanford and Jones	1.06	23	Sept. 13	do	1.46	39.5
Oct. 1	J. J. Sanford	1.45	38				

Daily discharge, in second-feet, of State canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	23	8	22	15	20
2	23	9	21	16	20
3	23	10	20	17	23
4	24	11	20	18	32
5	24	12	20	19	33
6	24	13	20	20	36
7	23	14	20	21	38

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1915.							1915.						
1	11	40	57	......	32	39	16	23	50	37	21	24	......
2	11	45	56	3.0	33	......	17	24	50	37	23	24	......
3	11	41	56	23	36	......	18	23	51	38	30	24	......
4	11	37	59	26	33	......	19	24	51	35	31	23	......
5	11	40	59	24	27	......	20	24	51	18	28	22	......
6	11	44	59	24	25	......	21	22	50	18	24	22	......
7	12	40	59	24	24	......	22	22	49	18	21	22	......
8	11	40	59	23	24	......	23	21	49	41	22	22	......
9	11	12	59	22	24	......	24	22	49	50	23	21	......
10	11	34	60	21	24	......	25	24	55	19	24	22	......
11	11	54	58	21	24	......	26	24	59	......	25	23	......
12	12	50	54	21	23	......	27	26	57	......	30	23	......
13	15	48	50	21	24	......	28	28	57	......	30	22	......
14	19	52	47	22	24	......	29	30	57	......	29	26	......
15	22	50	42	22	24	......	30	30	57	......	32	36	......
							31	34	......	......	31	......	......

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1916.						1916.					
1	25	46	60	2	44	16	44	55	30	4	42
2	25	50	58	6	44	17	44	56	25	5	40
3	25	54	54	10	43	18	44	55	22	8	40
4	25	54	54	5	43	19	45	56	26	8	40
5	25	54	54	4	42	20	44	56	32	13	39
6	27	54	56	3	42	21	39	58	34	26	36
7	29	54	55	3	42	22	37	57	34	31	37
8	31	54	54	2	43	23	34	57	35	37	38
9	32	54	52	2	46	24	34	56	25	39	38
10	33	54	54	2	44	25	36	56	14	41	38
11	34	55	51	2	44	26	37	56	14	42	38
12	36	54	53	2	42	27	41	57	14	42	39
13	38	54	56	2	40	28	40	58	14	44	40
14	44	54	54	4	42	29	44	58	3	46	40
15	44	54	37	4	42	30	48	60	8	50	40
						31	47	....	6	46	....

NOTE.—Defective gage-height record; discharge estimated, May 1-2, July 4-9, and Aug. 17-23, 1915, and May 1-4, 1916; discharge interpolated Aug. 12-13, 1915, and May 9, 11-12, June 5-8, 16, 22-23, July 25-28, 1916. Canal broken July 26 to Aug. 1, 1915, discharge zero.

Monthly discharge of State canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1916.		
October 1-21	24.2	1,010	May	36.5	2,240
1915.			June	55.0	3,270
May	19.1	1,170	July	36.7	2,260
June	47.3	2,810	August	17.2	1,060
July	36.9	2,270	September	40.9	2,430
August	23.3	1,430			
September	25.2	1,500			

LONG CANAL NEAR PANGUITCH, UTAH.

Location.—In the W. ½ sec. 2, T. 35 S., R. 5 W., 1¼ miles below head of canal and 3½ miles southeast of Panguitch, Garfield County, on road to Hillsdale.

Records available.—May 8, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder with outside and inside staff gages.

Discharge measurements.—Made by wading.

Channel and control.—Earth and gravel section. A permanent control is afforded by a wooden flume and diversion box just below gage.

Diversions.—East Bench canal diverts water a few feet below the gage.

Regulation.—Flow controlled by head gates 1¼ miles above.

Accuracy.—Stage-discharge relation permanent during periods of records, slight change between seasons of 1915 and 1916. One well-defined rating curve for each season. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection. Records excellent.

Canal diverts water from Sevier River in sec. 11, T. 35 S., R. 5 W. The water is used for irrigation in the vicinity of Panguitch.

Discharge measurements of Long canal near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 18	J. J. Sanford	1.22	52	May 5	J. J. Sanford	0.92	34
30	.....do	1.51	74	10	.....do	1.66	86
June 15	.....do	1.63	77	19	.....do	1.40	64
July 2	Sanford and Jones	1.82	90	June 1	.....do	1.52	72
15	Porter, Sanford and Jones.	1.57	78	14	.....do	1.34	58
				29	.....do	1.67	86
28	J. J. Sanford	1.58	78	Aug. 20	.....do	.54	13.7
Aug. 11	.....do	1.35	60	Sept. 13	.....do	.98	34.4
24	Sanford and Jones	1.22	48				
Oct. 1	J. J. Sanford	.97	34.7				

Daily discharge, in second-feet, of Long canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Oct.
1914-15.							
1	49	0	77	96	70	54	34
2	50	0	80	93	....	48	....
3	51	0	74	91	....	42	....
4	52	1.4	70	91	....	32	....
5	50	16	66	88	....	22	....
6	26	20	66	85	....	21	....
7	53	18	68	84	71	21	....
8	55	18	57	82	68	21	....
9	55	18	30	81	64	21	....
10	55	18	34	79	60	21	....
11	55	18	67	79	63	21	....
12	55	19	80	78	66	21	....
13	55	20	82	77	61	21	....
14	42	13	80	77	61	21	....
15	36	8.5	82	76	59	21	....
16	36	20	77	77	60	20	....
17	35	36	73	77	65	20	....
18	34	53	84	77	63	21	....
19	33	50	85	70	60	22	....
20	32	42	84	53	60	21	....
21	31	40	84	52	58	26	....
22	....	37	86	51	57	30	....
23	....	38	87	54	53	30	....
24	....	49	85	62	52	29	....
25	....	55	86	78	51	29	....
26	....	60	88	86	53	29	....
27	....	32	89	78	56	29	....
28	....	32	87	76	57	28	....
29	....	65	89	75	56	30	....
30	....	72	93	84	59	31	....
31	....	76	....	85	56	....	....

Daily discharge, in second-feet, of Long canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	32	74	84	......	69	16	......	68	60	43	......	18
2	......	32	74	84	......	68	17	......	67	84	49	......	18
3	......	32	74	84	......	67	18	......	64	82	48	......	18
4	......	32	75	83	......	65	19	......	64	81	53	4	19
5	......	32	76	82	......	53	20	......	64	82	62	14	20
6	......	32	76	84	......	46	21	......	61	82	68	22	20
7	......	......	75	86	......	47	22	......	66	82	74	54	20
8	......	......	74	87	......	50	23	......	78	88	74	51	20
9	......	......	75	87	......	53	24	......	78	88	76	51	20
10	......	83	76	93	......	50	25	......	75	87	66	51	19
11	......	81	75	86	......	43	26	......	72	86	50	50	19
12	......	76	70	80	......	36	27	......	71	86	24	50	20
13	......	74	66	76	......	36	28	20	71	86	15	57	20
14	......	73	61	69	......	30	29	32	73	85	6	72	21
15	......	71	56	45	......	18	30	32	75	84	2	82	18
							31	......	75	......	......	71	......

NOTE.—Discharge interpolated May 16–17, Aug. 8–9, and estimated 70 second-feet Aug. 2–6, 1915. Discharge estimated Apr. 28 to May 6, and July 29–30, 1916. No flow May 7–9 and July 31 to Aug. 18, 1916.

Monthly discharge of Long canal, near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1916.		
October 1–21	44.8	1,860	April 28–30	28.0	170
			May	57.2	3,520
1915.			June	77.3	4,600
May	30.5	1,880	July	61.9	3,810
June	76.3	4,540	August	20.3	1,250
July	77.2	4,750	September	34.0	2,020
August	61.6	3,790			
September	26.8	1,590			

EAST PANGUITCH CANAL NEAR PANGUITCH, UTAH.

LOCATION.—In NW. ¼ sec. 34, T. 34 S., R. 5 W., 200 yards below head of canal, 1½ miles southeast of Panguitch, Garfield County.

RECORDS AVAILABLE.—May 9, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder on right bank, with inside and outside gages.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Earth section. Concrete weir 15 feet below gage serves as control.

DIVERSIONS.—None above gage.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation permanent during 1916; changed once during 1915 season and during winter of 1915–16. Two fairly well defined rating curves for 1915, one well-defined curve for 1916. Operation of water-stage recorder satisfactory except for short periods during both years. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection. Records excellent.

Canal diverts water from Sevier River in sec. 34, T. 34 S., R. 5 W. The water is used for irrigation near Panguitch.

Discharge measurements of East Panguitch canal, near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 18	J. J. Sanford	0.68	17.5	May 10	J. J. Sanford	1.10	39.1
30	.....do	1.08	36.2	19	.....do	1.02	35.0
June 16	.....do	1.17	41.5	June 14	.....do	1.10	40.6
July 2	Sanford and Jones	1.20	43.9	28	.....do	1.20	44.8
15	Porter, Sanford, and Jones	1.08	35.2	July 31	.....do	.55	11.6
28	Sanford and Jones	1.26	46.0	Aug. 20	.....do	.80	21.3
Aug. 11	J. J. Sanford	.94	29.5	Sept. 13	.....do	.85	23.5
Oct. 1	.....do	.64	13.8				

Daily discharge, in second feet of East Panguitch canal, near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Oct.
1914-15.							
1	17		41	47	43	27	13
2	17		47	43	40	42	
3	17	0.8	47	46	28	48	
4	17	.9	46	53	29	48	
5	19	.9	44	46	34	45	
6	14	.9	40	41	34	45	
7	13	.2	45	40	36	41	
8	13	1.7	53	38	31	38	
9	13	2.0	63	43	28	37	
10	12	2.0	61	47	28	37	
11	12	1.8	56	44	27	36	
12	11	1.0	52	41	26	36	
13	11	0	47	37	30	36	
14	11	0	44	37	31	30	
15	10	16	43	39	30	23	
16	11	16	45	44	32	20	
17	10	16	52	43	41	20	
18	10	18	28	38	30	21	
19	10	18	22	37	25	21	
20	10	15	59	29	24	21	
21	10	14	60	28	23	20	
22		15	58	29	23	20	
23		14	56	41	24	20	
24		16	57	44	26	20	
25		22	60	51	25	20	
26		27	56	51	23	21	
27		32	54	50	21	21	
28		37	52	47	27	21	
29		36	46	46	20	20	
30		36	48	45	24	15	
31		37		44	19		

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1		39	39	43	21	34	16		39	35	24	23	25
2		40	54	41	11	31	17		36	40	24	23	25
3		40	64	40	26	30	18		35	45	33	22	33
4		40	66	38	21	29	19		34	43	35	22	33
5		40	68	35	28	41	20		40	41	31	21	11
6		41	69	41	24	43	21		42	47	31	20	11
7		41	68	46	24	43	22		41	64	30	19	10
8		41	65	46	24	45	23		46	62	26	18	10
9		40	61	45	24	47	24		46	60	24	30	10
10		39	60	44	31	45	25		43	57	21	43	10
11		38	57	41	28	48	26		38	55	18	43	10
12		37	51	40	17	28	27	25	35	53	16	43	10
13		43	45	37	25	24	28	39	37	49	14	38	10
14		48	38	34	24	24	29	39	39	47	13	35	10
15		41	34	23	23	25	30	39	39	46	13	50	10
							31		39		13	41	

NOTE.—1915: Discharge estimated May 13–17, from range of stage indicated by recording gage.
1916: No gage-height record; discharge interpolated May 9, July 23–28, Aug. 7–8; discharge estimat from data furnished by Water Master, Apr. 27 to May 7. On June 29, estimated flow of 15 second-fe and on Sept. 13, 18 second-feet returned to river fron wasteway below the station.

Monthly discharge of East Panguitch canal near Panguitch, Utah, for the years ending Sept. 30, 1915, and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1916.		
October 1-21	12.8	530	April 27-30	35.5	280
			May	39.9	2,450
1915.			June	52.8	3,140
May 3-31	13.7	790	July	31.0	1,910
June	49.4	2,940	August	27.2	1,670
July	42.2	2,590	September	25.4	1,510
August	28.5	1,750			
September	29.0	1,730			

PANGUITCH CREEK ABOVE CANALS, NEAR PANGUITCH, UTAH.

Location.—In SW. ¼ sec. 36, T. 34 S., R. 6 W., above all diversions and about 3 miles southwest of Panguitch, Garfield County.

Drainage area.—Not measured.

Records available.—October 20, 1915, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank with inside and outside staff gages. Gage reader, Omer Reid.

Discharge measurements.—Made by wading near gage or from pole bridge 400 feet above gage.

Channel and control.—One channel at all stages; control fairly permanent except during high stages.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.86 feet at 9 p. m., January 1, due to ice effect. Maximum open-water stage, 2.20 feet at 4 a. m., May 17 (discharge, 128 second-feet). Minimum stage recorded 0.57 foot at 10 a. m., January 28 (discharge 3 second-feet).

Ice.—Stage-discharge relation seriously affected by ice during winter.

Diversions.—Above all diversions.

Regulation.—Flow regulated by storage in Panguitch Lake.

Accuracy.—Stage-discharge relation not permanent; affected by ice during winter. Fairly well defined rating curves used October 20 to January 25, February 28 to April 16, April 22 to May 20, and June 1 to September 30. Operation of water-stage recorder satisfactory except for period July 15–29. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph or, for periods not covered by curves, by shifting control method. Records fair.

Discharge measurements of Panguitch Creek above canals, near Panguitch, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	J. J. Sanford	1.30	31.5	June 1	J. J. Sanford	1.88	75
Dec. 7	A. B. Purton	.91	14.6	14	.....do	2.00	88
Jan. 25	J. J. Sanford	.74	8.2	29	.....do	1.88	73
Feb. 28	.....do	.78	11.7	July 11	.....do	1.95	79
Apr. 16	.....do	1.45	50	31	.....do	1.36	40.8
22	.....do	1.14	45.6	Aug. 9	.....do	.78	12.7
May 5	.....do	1.10	40.3	18	.....do	.72	9.1
20	.....do	2.00	111	Sept. 12	.....do	1.38	44.7

Daily discharge, in second-feet, of Panguitch Creek above canals, near Panguitch, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	28	9.7	......	......	12	24	45	77	72	30	65
2	......	28	9.7	......	......	13	26	42	84	70	28	65
3	......	28	9.7	......	......	15	26	38	87	68	31	56
4	......	28	9.7	......	......	12	28	39	88	70	27	43
5	......	28	10	......	......	12	27	42	88	72	29	42
6	......	29	9.1	......	8.8	12	28	43	87	72	24	42
7	......	30	8.8	......	9.1	13	24	44	87	77	14	42
8	......	31	11	......	9.4	12	24	47	85	82	13	42
9	......	12	10	9.1	9.1	13	26	43	84	84	11	44
10	......	12	9.4	9.4	9.7	15	34	52	85	84	11	43
11	......	9.4	9.1	9.7	10	15	45	54	87	82	10	43
12	......	......	11	......	10	16	41	70	87	83	10	43
13	......	......	9.1	......	10	18	39	69	88	80	10	16
14	......	......	8.8	......	10	20	39	97	87	82	11	17
15	......	......	8.5	......	10	18	43	109	84	......	10	18
16	......	......	......	......	10	19	53	117	81	......	10	19
17	......	9.7	......	......	11	21	45	120	88	......	9.9	19
18	......	11	......	......	10	22	42	115	88	......	10	20
19	......	8.2	......	8.2	10	25	41	113	86	......	26	19
20	32	8.2	......	7.6	11	28	37	111	84	......	26	18
21	30	9.1	......	8.2	11	39	43	106	82	......	26	17
22	28	9.1	......	8.2	11	35	55	98	82	......	34	16
23	28	9.1	......	8.2	11	35	58	90	84	......	55	15
24	28	......	......	8.2	11	21	66	84	85	......	52	15
25	28	......	......	8.2	11	16	68	81	79	......	51	14
26	28	......	......	8.2	9.7	25	63	78	78	......	58	14
27	28	9.1	......	8.2	11	27	67	75	78	......	58	14
28	28	......	......	5.5	11	27	69	74	77	......	55	14
29	29	......	......	......	11	28	65	76	77	......	59	14
30	29	......	......	......	......	24	52	77	77	45	73	22
31	29	......	......	......	......	20	......	77	......	42	64	......

NOTE.—Discharge estimated on account of ice effect or missing gage-height record: Nov. 12–16, 24–26, 28–30, 9 second-feet; Dec. 16 to Jan. 8, 8 second-feet; Jan. 12–18, 9 second-feet; Jan. 29–31, 7.5 second-feet; Feb. 1–5, 8 second-feet; July 15–29, 62 second-feet.

Monthly discharge of Panguitch Creek above canals, near Panguitch, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 20–31	32	28	28.8	684
November	31	....	14.5	863
December	11	....	8.8	539
January	....	....	8.3	508
February	11	....	9.9	567
March	39	12	20.3	1,250
April	69	24	43.3	2,580
May	120	38	75.0	4,610
June	88	77	83.7	4,980
July	84	42	67.5	4,150
August	73	9.9	30.2	1,860
September	65	14	29.0	1,730
The period	....	....	....	24,300

BARTON AND LE FEVRE CANAL NEAR PANGUITCH, UTAH.

LOCATION.—In sec. 9, T. 34 S., R. 5 W., 400 feet below head of canal, just below mouth of Threemile Creek, and 3½ miles southeast of Panguitch, Garfield County.

RECORDS AVAILABLE.—May 16 to September 30, 1915; April 26 to July 26, 1916; miscellaneous measurements made in 1914.

GAGE.—Vertical staff on left bank; read by Zera Church.

Discharge measurements.—Made by wading near gage.

Channel and control.—East section. Shifting control.

Accuracy.—Frequent changes in stage-discharge relation due to silting and scouring of canal bed. Rating curves poorly defined. Staff gage read to hundredths once a day. Daily discharge ascertained by applying daily gage height to rating table and by shifting-control method. Records only roughly approximate.

Canal diverts water from Sevier River on left side, in sec. 9, T. 34 S., R. 5 W. Water is used for irrigation in valley below.

Discharge measurements of Barton and Le Fevre canal near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 31	J. J. Sanford	1.20	9.4	May 10	J. J. Sanford	1.22	8.9
June 15	....do	.87	5.6	June 2	....do	1.20	7.3
July 1	Sanford and Jones	1.18	7.3	14	....do	1.05	4.2
14	Porter and Sanford	1.00	6.2	28	....do	1.07	5.0
29	Sanford and Jones	1.30	8.6	July 11	....do	1.14	5.9
Aug. 11	J. J. Sanford	.80	3.7				
25	Sanford and Jones	.84	4.1				

Daily discharge, in second-feet, of Barton and Le Fevre canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1915.						1915.					
1		8.9	5.5	8.6	0.9	16		5.0	7.5	3.1	8.6
2		8.4	7.5	8.4	.9	17		0	7.7	9.0	8.8
3		10	7.3	7.0	0	18		6.0	10	7.3	7.9
4		7.5	7.7	7.5	0	19		7.1	6.2	7.3	7.7
5		7.5	7.5	6.0	0	20		4.5	11	7.0	5.0
6		7.5	7.5	5.7	0	21		4.0	9.2	7.0	4.1
7		7.8	7.5	5.0	8.8	22		0	8.8	6.8	3.1
8		7.5	8.3	4.1	8.6	23		0	9.9	6.6	2.9
9		9.7	6.0	4.1	8.6	24		3.9	10	5.9	2.9
10		9.7	5.2	3.9	8.6	25		6.4	9.2	4.0	3.1
11		9.5	5.6	3.5	7.7	26		5.7	9.7	3.1	2.8
12		7.3	5.0	3.7	7.9	27		5.5	11	3.5	2.8
13		13	4.8	2.9	7.9	28	8.2	5.7	9.5	2.3	2.2
14		13	6.8	2.8	7.7	29	8.4	5.7	9.0	1.5	0
15		7.1	7.1	2.9	8.1	30	8.4	5.9	9.2	1.4	0
						31	9.0		9.0	.9	

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1916.					1916.				
1		3.5	8.5	4.3	16		4.2	3.9	3.4
2		3.5	7.3	3.4	17		7.1	3.8	2.6
3		3.5	7.2	3.5	18		6.0	3.9	1.8
4		3.5	6.4	3.5	19		5.9	4.6	2.3
5		3.5	5.8	3.3	20		7.0	4.9	2.5
6		3.5	5.7	3.1	21		5.8	5.1	4.5
7		3.5	5.6	3.1	22		4.8	6.0	4.5
8		3.5	5.7	5.8	23		7.8	5.8	5.3
9		3.5	5.5	7.4	24		7.6	5.8	5.3
10		9.1	5.4	6.6	25		6.6	5.1	5.3
11		8.5	5.1	6.4	26	3.5	5.6	5.1	5.3
12		6.5	5.0	7.1	27	3.5	5.5	5.1	0
13		6.2	4.7	6.2	28	3.5	5.7	5.2	0
14		6.6	4.6	7.3	29	3.5	6.4	5.2	0
15		4.9	4.7	7.3	30	3.5	6.4	4.8	0
					31		8.5		0

Monthly discharge of Barton and Le Fevre canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
May 28-31	8.5	70	Apr. 26-30	3.5	35
June	6.7	395	May	5.6	345
July	7.9	490	June	5.4	320
August	5.0	300	July	3.9	240
September	4.6	275	The period		940
The period		1,530			

McEWEN CANAL NEAR PANGUITCH, UTAH.

Location.—About on line between secs. 4 and 9, T. 34 S., R. 5 W., 100 feet below head of canal, just below mouth of Threemile Creek and about 3½ miles north of Panguitch, Garfield County.

Records available.—May 9, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder, with outside and inside staff gages, May 9 to 25, 1914, when it was washed out by flood from Hatchtown reservoir; temporary vertical staff on left bank, 100 feet from head of canal, was installed July 2; 1914; replaced by Stevens water-stage recorder at original location May 19, 1915, datum lowered 1 foot. Gage reader, Zera Church.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of clay; fairly permanent.

Diversions.—None above gage.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed June 23, 1915, and on July 31, 1916, by sudden rise of river. Rating curves fairly well defined for each season. Water-stage recorder operated satisfactorily during 1916; record interrupted for short period in 1915, staff gage read. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for days of considerable variation, for which were used the means of discharge obtained by applying hourly gage height to rating table. Records good.

Canal diverts water from Sevier River, in the NW. ¼ sec. 9, T. 34 S., R. 5 W., about 100 feet above gage. Water is used for irrigation below Panguitch, on ranch of A. A. Church.

Discharge measurements of McEwen canal near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 31	J. J. Sanford	1.86	26.3	June 2	J. J. Sanford	1.03	21.7
June 15	.....do	1.58	22.5	14	.....do	1.28	25.4
July 1	.....do	1.42	28.5	28	.....do	1.10	23.3
14	Porter and Sanford	1.05	22.4	July 11	.....do	.85	17.3
29	Sanford and Jones	1.01	21.4	Aug. 9	.....do	.58	1.5
Aug. 11	J. J. Sanford	.90	19.5	Sept. 12	.....do	1.16	25.1
Oct. 1	.....do	.98	20.6				

Daily discharge, in second-feet, of McEwen canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.
1915.							1916.					
1	......	26	27	21	20	21	1	......	21	21	0.5	20
2	......	27	30	21	22	......	2	......	21	21	.5	19
3	......	27	30	20	24	......	3	......	21	21	.5	19
4		27	29	20	25	......	4	......	22	21	.5	19
5	......	26	29	20	25	......	5	......	23	21	.5	19
6	......	24	28	20	25	......	6	......	23	20	.5	21
7	......	25	24	20	25	......	7	......	23	19	.5	21
8	......	25	19	20	24	......	8	......	24	18	.5	21
9	......	26	23	20	24	......	9	......	27	18	1.3	23
10	......	26	22	20	23	......	10	......	27	18	1.3	22
11	......	25	21	19	23	......	11	......	28	18	1.1	23
12	......	22	22	19	22	......	12	......	28	16	1.0	24
13	......	22	21	19	22	......	13	......	27	16	1.0	23
14	......	21	22	19	22	......	14	......	27	17	.9	23
15	......	22	24	19	22	......	15	......	26	17	.7	24
16	......	21	25	19	22	......	16	......	26	17	.6	24
17	......	20	25	19	21	......	17	......	25	15	.5	24
18	......	20	26	19	21	......	18	......	24	14	.2	25
19	26	23	25	19	22	......	19	......	24	13	.1	25
20	16	21	24	19	22	......	20	......	26	13	.0	25
21	16	19	21	19	22	......	21	......	25	13	.0	25
22	16	17	21	19	22	......	22	4	24	12	.0	25
23	16	24	22	19	22	......	23	12	24	12	.0	25
24	16	33	20	19	22	......	24	13	23	12	.0	25
25	16	33	21	19	22	......	25	21	23	13	.0	25
26	16	31	22	19	22	......	26	21	23	15	.0	25
27	26	30	22	20	22	......	27	21	23	16	.0	25
28	28	30	22	20	22	......	28	21	23	16	.2	25
29	28	30	21	20	22	......	29	21	22	16	7.6	25
30	28	28	22	20	21	......	30	21	21	15	16.0	25
31	27	......	22	20	......	......	31	20	......	5	21.0	......

NOTE.—1915: Recording gage not in operation June 6–12; one staff gage reading daily. Discharge interpolated June 4, 13–14. 1916: Defective gage-height record, discharge estimated July 31 to Aug. 8, and Aug. 29–30. No flow Aug. 20–27.

Monthly discharge of McEwen canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
May 19–31	21.2	545	May 22–31	17.5	350
June	25.0	1,490	June	24.1	1,430
July	23.6	1.450	July	16.1	990
August	19.5	1,200	August	1.8	110
September	22.5	1,340	September	23.1	1,370

OLD HOUSTON CANAL NEAR PANGUITCH, UTAH.

LOCATION.—In the SW. ¼ sec. 4, T. 34 S., R. 5 W., at Church ranch, half a mile below mouth of Threemile Creek, and 3½ miles southeast of Panguitch, Garfield County.

RECORDS AVAILABLE.—June 1 to September 30, 1915; April 26 to August 2, 1916; some miscellaneous measurements during 1914.

GAGE.—Vertical staff, read by Zera Church.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Shifting gravel and clay.

ACCURACY.—Stage-discharge relation changed frequently during 1916. Rating curve for 1915 well defined; for 1916, several poorly defined curves. Staff gage read to hundredths once a day. Daily discharge determined by applying daily gage height to rating table and by shifting-control method. Records fair.

Canal diverts water from Sevier River for irrigation.

Discharge measurements of Old Houston canal near Panguitch, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
June 15	J. J. Sanford	1.58	13.8	May 10	J. J. Sanford	1.78	22.8
July 1	do	1.21	6.7	June 2	do	1.58	13.1
29	do	.92	2.7	14	do	1.08	3.9
Aug. 11	do	1.20	7.0	28	do	1.32	7.1
25	do	1.06	4.5	July 11	do	1.48	7.9
				31	do	1.04	2.8

Daily discharge, in second-feet, of Old Houston canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1915.					1915.				
1	3.7	8.1	5.1	6.4	16	11	1.8	6.1	8.5
2	13	7.1	6.4	12	17	11	1.8	8.5	8.1
3	13	7.8	1.7	12	18	11	1.8	6.4	8.1
4	14	9.2	.7	13	19	11	1.1	6.1	8.1
5	13	9.2	.7	13	20	9.2	12	5.1	7.8
6	13	8.5	3.5	12	21	8.5	12	3.2	7.4
7	14	8.9	6.4	11	22	8.5	12	2.1	7.4
8	13	12	6.7	11	23	8.7	8.9	1.8	7.1
9	14	8.1	6.4	8.5	24	2.5	9.2	3.2	7.1
10	13	8.1	6.4	8.1	25	2.5	8.5	3.2	6.7
11	11	4.3	5.1	7.8	26	1.8	8.9	2.5	6.7
12	10	4.0	6.7	8.1	27	1.6	8.1	2.7	6.4
13	14	3.5	6.4	7.8	28	1.8	2.0	3.0	6.4
14	13	1.1	6.7	7.8	29	10	1.8	3.7	6.1
15	12	1.6	6.1	8.1	30	11	4.0	6.4	4.8
					31	....	5.1	5.4	....

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1916.						1916.					
1	....	23	8	10	1.1	16	....	17	3.1	14	....
2	....	23	13	9.6	.5	17	....	15	2.9	11	....
3	....	23	13	9.4	....	18	....	15	12	11	....
4	....	23	12	9.4	....	19	....	15	2.5	10	....
5	....	23	9.4	8.9	....	20	....	15	5.1	10	....
6	....	23	5.1	8.9	....	21	....	13	4.8	10	....
7	....	23	10	8.3	....	22	....	13	5.4	10	....
8	....	23	11	7.8	....	23	....	13	6.7	8.5	....
9	....	23	12	9.0	....	24	....	12	6.7	8.5	....
10	....	22	12	8.9	....	25	....	11	10	8.5	....
11	....	22	4.4	8.7	....	26	12	9	10	10	....
12	....	21	4.4	8.7	....	27	23	9	6.7	9.9	....
13	....	21	3.8	8.3	....	28	23	9	6.7	9.6	....
14	....	18	3.6	9.9	....	29	23	10	10	8.5	....
15	....	17	3.3	13	....	30	23	7	11	1.5	....
						31	....	4	....	2.0	....

NOTE.—1916: Discharge interpolated Apr. 27–30 May 1–3 and 5–8; estimated May 28 to June 1, June 29 to July 10 and July 14–15.

Monthly discharge of Old Houston canal near Panguitch, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet)
1915.			1916.		
June	9.6	575	April 26–30	20.8	205
July	6.5	400	May	16.6	1,020
August	4.7	285	June	7.6	455
September	8.4	500	July	9.1	560
			August 1–2	.8	5
The period	....	1,760	The period	....	2,245

FOX CANAL NEAR CIRCLEVILLE, UTAH.

Location.—In SE. ¼ sec. 3, T. 31 S., R. 4 W., 300 feet below head of canal and 3½ miles southwest of Fullmer store in Circleville, Piute County.

Records available.—May 14, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on left bank, with inside and outside staff gages.

Discharge measurements.—Made by wading.

Channel and control.—Earth section. Wooden flume with removable crest board just below gage.

Diversions.—None from canal above gage.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed several times during 1915 by removal and insertion of crest board on control. During 1916 these changes in control were less frequent. Several fairly well defined rating curves used. Operation of water-stage recorder satisfactory throughout each season. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for days of considerable variation, for which were used the means of discharge obtained by applying hourly gage height to rating table. Records fair for 1915 and good for 1916.

Canal diverts water from right bank of Sevier River, in sec. 3, T. 31 S., R. 4 W. Water is used for irrigation in vicinity of Circleville.

Discharge measurements of Fox canal near Circleville, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec. ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 28	J. J. Sanford	2.87	17.3	Mar. 30	J. J. Sanford	3.14	32.0
May 17	.....do	2.00	40.0	May 11	.....do	2.56	36.7
29	.....do	2.28	41.8	18	.....do	2.60	37.9
July 1	.....do	2.18	33.6	31	.....do	2.76	37.7
14	Porter and Sanford	[a] .94	6.1	June 13	.....do	2.32	30.4
27	J. J. Sanford	2.72	23.0	28	.....do	1.28	14.0
Aug. 10	.....do	2.36	14.2	July 11	.....do	[b] 1.30	13.9
23	.....do	2.07	8.1	29	.....do	[c] .12	2.9
Oct. 9	.....do	2.88	23.3	Aug. 18	.....do	1.76	28.5
				Sept. 12	.....do	[d] 1.42	21.6

[a] Crest board placed in control raising gage height to 1.84.
[b] With additional crest board in, gage read 2.33; board removed, 1.30.
[c] Crest board removed.
[d] Crest board replaced; board in, gage read 1.62; board removed, 1.42.

Daily discharge, in second-feet, of Fox canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	36	7	32	13	32
2	36	8	32	14	32
3	36	9	32	15	32
4	35	10	32	16	32
5	35	11	32	17	30
6	32	12	32		

Daily discharge, in second-feet, of Fox canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							1916.						
1	......	8	42	34	21	10	1	29	35	38	14	......	3
2	......	5	41	33	20	9	2	30	36	38	16	......	3
3	......	1	42	34	19	11	3	30	38	38	15	21	3
4	......	0	43	32	17	26	4	30	35	39	14	......	3
5	......	2	42	36	16	24	5	30	32	41	15	......	3
6	......	11	42	35	17	22	6	28	32	40	14	36	3
7	......	12	44	34	16	22	7	29	34	40	14	14	12
8	......	13	42	33	15	20	8	29	36	38	14	......	16
9	......	17	45	18	14	20	9	30	37	38	14	......	20
10	......	17	45	8	14	21	10	30	35	36	16	......	18
11	......	16	43	8	13	22	11	31	37	38	12	......	18
12	......	14	41	7	10	21	12	30	38	34	12	......	22
13	......	16	40	6	7	21	13	29	38	30	10	......	24
14	......	25	39	7	9	21	14	29	38	26	12	......	22
15	......	22	38	8	9	21	15	26	37	22	15	......	21
16	......	27	37	7	10	21	16	10	37	20	18	15	22
17	......	36	36	7	10	21	17	......	37	18	19	28	21
18	......	41	33	7	9	20	18	......	36	16	18	28	20
19	......	40	37	8	9	21	19	......	36	18	17	26	18
20	......	41	34	9	9	21	20	......	38	34	16	26	19
21	......	40	34	12	9	21	21	......	36	39	16	26	16
22	......	40	37	12	9	21	22	......	34	36	16	20	17
23	......	40	35	18	9	20	23	......	32	33	16	8	17
24	......	36	35	21	9	20	24	......	32	33	16	3	17
25	......	28	34	22	9	20	25	8	32	34	22	3	17
26	......	36	35	24	9	23	26	33	30	27	30	3	16
27	......	36	34	24	9	30	27	39	30	14	3	3	16
28	16	41	37	25	9	30	28	39	34	13	3	3	15
29	14	43	38	24	9	30	29	23	39	14	3	3	16
30	10	43	36	22	9	30	30	23	39	14	3	3	15
31	......	42	......	21	9	......	31	......	38	......	13	3	......

NOTE.—1915: Discharge estimated June 16–17, July 28, Sept. 28–30, and Oct. 1–9; discharge Oct. 1–9, 24 sec.-ft. 1916: Discharge estimated Apr. 26–27, 30, May 1–3, June 12–13, July 27–30, Aug. 16–17, 22–31, Sept. 1–6. No flow Apr. 17–24, Aug. 1–2, 4–5, 8–15.

Monthly discharge of Fox canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-22	32.7	1,430	October 1-9	[a] 23.9	430
1915.			1916.		
April 28-30	13.3	80	April	20.8	1,240
May	25.4	1,560	May	35.5	2,180
June	38.7	2,300	June	30.0	1,780
July	19.2	1,180	July	14.1	870
August	11.7	720	August	8.8	540
September	21.3	1,270	September	15.0	890

[a] Estimated.

CIRCLEVILLE CANAL NEAR CIRCLEVILLE, UTAH.

LOCATION.—In NE. ¼ sec. 3, T. 31 S., R. 4 W., three-quarters of a mile below head of canal, and 3 miles southwest of Fullmer store in Circleville, Piute County.

RECORDS AVAILABLE.—May 14, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder, with inside and outside vertical staff gages.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Earth section. Wooden weir 3 feet below gage serves as control.

Diversions.—Above all diversions from the canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed slightly at frequent intervals during 1915 and less frequently in 1916. Changes due to accumulation and subsequent removal of sand above crest of control.

Standard rating curve used for each year with shifts to parallel curves for changes in stage-discharge relation. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection; shifting-control method used for periods of change. Records good.

Canal diverts water from left bank of Sevier River in sec. 3, T. 31 S., R. 4 W. a short distance below head of Fox canal. Water is used for irrigation near Circleville.

Discharge measurements of Circleville canal near Circleville, Utah, during the years ending Sept. 30, 1915, and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 28	J. J. Sanford	1.20	56.0	Mar. 30	J. J. Sanford	0.55	19.8
May 4	.....do	1.08	54.0	Apr. 21	.....do	.48	17.2
17	.....do	.76	34.3	May 11	.....do	1.10	52.0
29	.....do	.92	44.9	18	.....do	1.08	48.2
July 1	Sanford and Jones	.82	33.7	31	.....do	.97	41.0
14	Porter and Sanford	.74	30.1	June 13	.....do	1.18	57.0
27	Sanford and Jones	1.10	49.5	28	.....do	.94	45.0
Aug. 10	J. J. Sanford	.72	27.0	July 11	.....do	.85	39.5
23	Sanford and Jones	.72	28.6	29	.....do	.97	42.9
Oct. 9	J. J. Sanford	.68	28.0	Aug. 9	.....do	.50	18.4
				Sept. 12	.....do	.78	34.0

Daily discharge, in second-feet, of Circleville canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1914-15.								
1	52	....	54	44	34	31	60	36
2	51	....	53	45	33	29	60	34
3	51	....	54	45	33	28	61	33
4	50	....	54	47	33	28	58	31
5	48	....	54	47	35	29	54	31
6	46	....	55	46	34	30	51	31
7	46	....	56	45	34	29	47	31
8	46	....	54	45	36	28	48	31
9	46	....	54	46	40	27	46	30
10	46	....	54	52	39	28	45	....
11	46	....	54	60	38	29	45	....
12	46	....	55	59	35	28	45	....
13	46	....	53	58	32	28	45	....
14	46	....	49	64	30	26	46	....
15	46	....	48	74	28	27	47	....
16	46	....	43	66	26	28	46	....
17	46	....	41	59	26	32	46	....
18	46	....	50	54	27	30	45	....
19	46	....	50	54	28	28	47	....
20	46	....	49	51	30	28	47	....
21	46	....	48	47	38	28	45	....
22	44	....	48	44	37	28	43	....
23	....	....	47	51	42	28	41	....
24	....	....	47	58	44	30	40	....
25	....	....	48	52	36	30	40	....
26	....	....	48	46	47	30	40	....
27	....	....	46	43	51	31	40	....
28	....	55	46	40	46	31	41	....
29	....	56	45	39	41	31	41	....
30	....	55	45	36	35	31	38	....
31	....	....	45	....	33	31	....	....

Daily discharge, in second-feet, of Circleville canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	21	48	41	42	39	28	16	31	49	52	50	35	35
2	22	51	42	43	45	27	17	30	48	50	48	43	36
3	22	54	41	42	44	27	18	18	48	48	46	48	36
4	22	57	41	41	40	27	19	17	48	48	45	48	37
5	21	56	42	41	44	25	20	17	45	46	44	46	38
6	21	55	42	39	47	26	21	17	42	45	44	44	38
7	21	54	42	39	32	28	22	18	42	46	44	41	38
8	20	54	42	39	24	29	23	18	41	46	42	37	38
9	20	53	44	39	18	31	24	18	41	46	44	36	38
10	20	52	47	41	19	32	25	27	41	44	50	32	38
11	20	51	50	40	21	32	26	31	41	46	56	32	37
12	22	51	54	40	28	33	27	31	41	46	58	30	37
13	22	51	56	39	29	34	28	38	41	45	55	30	37
14	22	50	54	39	28	35	29	56	41	44	42	29	38
15	24	50	53	45	25	35	30	52	41	44	41	30	38
							31	......	41	......	51	31	......

NOTE.—1915: Recording gage clock stopped, discharge estimated from range of stage indicated by recorder, July 28-29, Aug. 21-22, Sept. 4-5, and Oct. 4-8; no gage record, discharge estimated from record of Sevier River at Kingston Aug. 28 to Sept. 2. 1916: No gage record, discharge interpolated May 2-3, 5-10, 13-17, 26-30, June 9-12, and 14-16.

Monthly discharge of Circleville canal, near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-22	46.9	2,040	October 1-9	32.0	570
1915.			1916.		
April 28-30	55.3	330	April	24.6	1,460
May	49.9	3,070	May	47.7	2,930
June	50.6	3,010	June	46.2	2,750
July	35.5	2,180	July	44.2	2,720
August	29.0	1,780	August	34.7	2,130
September	46.6	2,770	September	33.6	2,000

OLD KINGSTON CANAL NEAR CIRCLEVILLE, UTAH.

LOCATION.—In SW. ¼ sec. 35, T. 30 S., R. 4 W., 200 yards below head of canal and 2 miles southwest of Fullmer store in Circleville, Piute County.

RECORDS AVAILABLE.—May 14, 1914, to September 30, 1916, during irrigation seasons only.

GAGE.—Stevens water-stage recorder on left bank with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading 50 feet above gage.

CHANNEL AND CONTROL.—Earth section. Crest of wooden weir just below gage serves as control.

DIVERSIONS.—Not known.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation changed frequently during 1915 due to accumulation of silt above control; permanent during 1916 except for the period April 26 to May 13, on which dates sudden changes in flow caused changes in control. Several rating curves used for 1915 season; one well-defined curve for 1916 with a parallel curve through measurement made May 11, for the period April 26 to May 13. Operation of water-stage recorder satisfactory except for periods indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records for 1915 good; for 1916, excellent.

Canal diverts water from right bank of Sevier River in the SW. ¼ sec. 35, T. 30 S., R. 4 W. Water is used for irrigation near Circleville.

Discharge measurements of Old Kingston canal near Circleville, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 28	J. J. Sanford	1.50	66	Apr. 21	J. J. Sanford	0.40	4.6
May 4	do	1.26	49.6	May 11	do	1.38	59
17	do	1.16	43.2	18	do	1.62	67
29	do	1.66	75	June 2	do	1.72	71
July 1	do	1.03	31.0	13	do	1.60	68
14	Porter and Sanford	.90	25.2	28	do	1.64	66
27	J. J. Sanford	1.71	73	July 11	do	1.12	39.1
Aug. 11	do	.89	26.8	29	do	.86	23.1
Aug. 23	do	.96	27.1	Sept. 12	do	1.50	58
Oct. 9	do	1.06	40.0	13	do	1.34	49.2

Daily discharge, in second-feet, of Old Kingston canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1914–15.								
1	49		50	66	31	49	31	45
2	52		50	65	32	46	34	41
3	56		50	65	34	42	40	41
4	53		49	67	33	39	47	40
5	52		49	61	38	36	45	38
6	53		47	55	45	37	40	38
7	51		46	51	39	37	40	38
8	50		42	50	31	35	40	40
9	53		40	52	30	33	40	40
10	20		39	56	30	30	40	
11	20		38	53	28	29	39	
12	20		38	49	26	31	38	
13	20		37	46	27	34	37	
14	20		47	43	25	32	39	
15	20		45	40	21	33	40	
16	20		45	55	19	34	42	
17	20		43	72	18	34	43	
18	20		38	72	17	34	45	
19	20		33	77	19	31	46	
20	20		30	60	21	29	44	
21	20		32	54	42	29	43	
22	11		32	46	40	29	43	
23			34	40	52	28	41	
24			44	48	60	29	40	
25			47	57	50	28	40	
26			64	49	65	29	46	
27			71	45	68	30	49	
28		69	78	43	65	30	50	
29		73	78	37	58	31	51	
30		52	77	34	54	31	48	
31			68		52	29		

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	16	60	71	56	11		16	24	67	58	39		50
2	16	56	73	50	12		17	17	67	53	41		50
3	17	56	72	48	11		18	10	67	49	42	1	51
4	17	57	69	47			19	8	62	48	41	1	50
5	17	58	70	46			20	6	63	41	40	15	50
6	16	58	70	44			21	5	63	37	39	40	52
7	16	61	70	40			22	5	64	36	39	44	53
8	16	61	70	40			23	5	58	35	38	48	46
9	17	61	67	38			24	5	58	32	40	51	22
10	18	59	67	39			25	4	58	60	49		18
11	20	59	67	34			26	36	56	76	56		11
12	23	60	66	32		58	27	58	55	70	44		7
13	24	68	66	31		50	28	61	55	68	40		4
14	25	71	64	31		49	29	64	67	68	24		26
15	24	67	61	34		49	30	67	75	67	24		36
							31		68		30		

NOTE.—1915: Inlet pipe clogged, discharge estimated May 1–3; interpolated May 15–16, 18–19. 1916: No gage-height record, discharge interpolated Aug. 22–23; estimated Aug. 25–31, 52 second-feet; Sept. 1–11, 55 second-feet. No flow Aug. 4–17.

Monthly discharge of Old Kingston canal near Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-22	32.7	1,430	October 1-9	40.1	715
1915.			1916.		
April 28-30	64.7	385	April	21.9	1,300
May	47.8	2,940	May	61.8	3,800
June	53.6	3,190	June	60.7	3,610
July	37.7	2,320	July	39.9	2,450
August	33.2	2,040	August	19.3	1,190
September	42.0	2,500	September	44.6	2,650

DALTON CANAL AT CIRCLEVILLE, UTAH.

Location.—In SW. ¼ sec. 25, T. 30 S., R. 4 W., 800 feet below canal heading and a quarter of a mile southeast of Fullmer store in Circleville, Piute County.

Records available.—July 1, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Vertical staff on right bank 100 feet below spillway; read by J. P. Meeks.

Discharge measurements.—Made by wading or from pole bridge.

Channel and control.—Earth section. Row of stakes driven into canal bed just below gage serves as control at low stages.

Diversions.—None above gage.

Regulation.—Flow controlled by headgates.

Accuracy.—Stage-discharge relation changed frequently during each irrigation season. Rating curves fairly well defined. Staff gage read to hundredths once a day. Daily discharge ascertained by applying daily gage height to rating table, principally by shifting-control method. Records only fair.

Canal diverts water from left bank of Sevier River in sec. 35, T. 30 S., R. 4 W. Water is used for irrigation in and below Circleville.

Discharge measurements of Dalton canal at Circleville, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 28	J. J. Sanford	4.28	14.5	May 18	J. J. Sanford	4.62	20.8
May 29	.....do	4.56	19.1	June 2	.....do	4.40	19
July 1	.....do	3.86	6.1	13	.....do	4.50	19.5
14	Porter and Sanford	4.26	11.6	28	.....do	4.38	15.8
27	J. J. Sanford	4.50	15.0	July 10	.....do	4.48	11.3
Aug. 11	.....do	3.54	2.6	29	.....do	3.76	2.0
23	.....do	3.94	8.2	Aug. 10	.....do	4.20	8.0
				18	.....do	4.42	13.5
1916.				Sept. 12	.....do	3.76	3.4
May 4	.....do	4.04	10.6				

Daily discharge, in second-feet, of Dalton canal at Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							1915.						
1	......	12.5	18	6.3	5.6	26	16	......	16	24	10	8.9	13
2	......	12.5	8.0	11	5.6	23	17	......	19	24	9.8	11	0
3	......	12.5	8.5	10	7.6	4.4	18	......	20	23	10	16	0
4	......	12.5	9.8	11	3.3	4.4	19	......	22	20	11	18	3.3
5	......	9.5	9.5	11	3.3	3.3	20	......	19	13	10	8.1	13
6	......	9.8	8.7	11	5.6	2.4	21	......	15	14	18	8.1	1.1
7	......	7.5	11	12	4.9	0	22	......	15	12	18	6.8	.8
8	......	8.0	12	11	3.3	7.8	23	......	12	10	20	7.6	6.1
9	......	8.0	12	11	2.9	7.6	24	......	18	0	0	7.1	6.1
10	......	9.5	14	10	2.2	7.3	25	......	18	0	24	6.8	2.2
11	......	12	14	14	2.9	12	26	......	0	0	28	9.5	7.1
12	......	12	13	11	3.3	6.1	27	......	10	22	13	10	8.1
13	......	16	15	11	3.7	3.6	28	......	10	20	7.8	11	15
14	......	17	15	11	5.4	19	29	15	16	20	6.3	11	15
15	......	29	24	11	8.7	20	30	15	13	19	11	9.2	13
							31	15	22	......	10	11.0	......

Daily discharge, in second-feet, of Dalton canal at Circleville, Utah, for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1916.						1916.					
1	......	19	13	4	0	16	8	17	8	13	11
2	......	18	16	6	6	17	16	11	8	19	10
3	......	22	10	3	8	18	15	8	7	21	11
4	......	18	9	6	7	19	23	8	6	14	13
5	......	17	8	6	7	20	24	8	6	12	13
6	......	26	11	6	7	21	20	13	12	3	8
7	......	20	14	10	8	22	20	16	13	0	9
8	......	19	14	6	4	23	22	15	13	0	3
9	......	19	15	11	1	24	16	14	16	0	7
10	......	19	18	8	2	25	16	0	13	0	2
11	......	28	7	8	2	26	15	14	9	0	1
12	24	29	9	7	2	27	14	20	3	0	1
13	14	20	5	7	4	28	14	17	3	0	1
14	18	20	5	7	3	29	14	14	2	0	1
15	9	19	5	13	11	30	14	13	2	0	4
						31	14	......	2	0	......

Monthly discharge of Dalton canal at Circleville, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
Apr. 28-30	....	....	15.0	89
May	29	0	14.0	861
June	24	0	13.8	821
July	28	0	11.9	732
August	18	2.2	7.37	453
September	26	0	8.42	501
The period	....	....	....	3,460
1916.				
May 12-31	24	....	16.5	654
June	29	0	16.7	994
July	18	2.0	9.10	560
August	21	0	6.13	377
September	13	0	5.57	331
The period	....	....	....	2,920

MITCHELL SLOUGH CANAL NEAR JUNCTION, UTAH.

Location.—In NE. ¼ sec. T. 30 S., R. 3 W., several miles below head of canal and 2½ miles south of Junction, Piute County.

Records available.—May 15, 1914 to September 30, 1916, irrigation seasons only.

Gage.—Stevens water-stage recorder, with outside and inside gages.

Discharge measurements.—Made by wading.

Channel and control.—Earth section. Concrete weir just below gage serves as control.

Diversions.—None above gage.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation subject to changes in summer due to accumulation of moss and silt above control. Standard rating curve well defined. Operation of water-stage recorder satisfactory throughout each irrigation season, except as indicated in footnote to table of daily discharge. Daily discharge ascertained by shifting-control method and by directly applying to rating table the mean daily gage height determined by inspecting recorder graph. Records for 1915 fair; for 1916, good.

Canal diverts water from Mitchell Slough, probably in sec. 19, T. 30 S., R. 3 W. Water is used for irrigation above Junction.

Discharge measurements of Mitchell Slough canal near Junction, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 26	J. J. Sanford	0.72	14.6	Mar. 30	J. J. Sanford	0.42	4.5
May 17	.....do	.78	17.5	Apr. 21	.....do	.80	14.5
29	.....do	.75	16.6	May 3	.....do	.74	15.7
June 18	.....do	.75	14.0	11	.....do	.88	20.3
July 14	Porter and Sanford	.64	9.8	18	.....do	.92	24.8
27	Sanford and Jones	.74	15.6	June 13	.....do	.72	14.4
Aug. 10	J. J. Sanford	.62	9.9	28	.....do	.82	16.1
23	Sanford and Jones	.62	9.7	July 10	.....do	.70	12.2
Oct. 23	J. J. Sanford	.72	15.2	28	.....do	.86	20.3
				Aug. 10	.....do	.86	18.1
				Sept. 11	.....do	.88	22.8

Daily discharge, in second-feet, of Mitchell Slough canal near Junction, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	April.	May.	June.	July.	Aug.	Sept.	Oct.
1914-15.								
1	10	....	....	18	13	11	16	12
2	10	....	....	18	14	11	16	12
3	9	....	....	18	14	11	17	13
4	9	....	....	22	14	12	18	13
5	9	....	....	21	14	13	18	13
6	9	....	....	21	15	13	18	13
7	9	....	....	20	13	13	18	14
8	9	....	....	18	12	12	18	14
9	9	....	....	14	12	10	16	14
10	10	....	....	14	14	10	16	14
11	11	....	....	13	12	12	16	14
12	11	....	....	14	10	11	15	14
13	12	....	....	12	9.5	11	15	....
14	13	....	....	9.9	9.1	11	15	....
15	14	....	....	11	8.4	11	15	....
16	14	....	....	12	8.0	11	16	....
17	14	....	18	11	8.0	11	16	....
18	14	....	20	14	9.1	11	16	....
19	14	....	20	16	8.4	10	16	....
20	14	....	21	16	8.4	10	16	....
21	14	....	23	16	9.6	10	16	....
22	14	....	21	16	13	10	15	....
23	....	....	20	14	12	10	14	15
24	....	....	19	13	12	10	14	....
25	....	....	18	14	12	10	13	....
26	....	14	18	15	13	10	13	....
27	....	16	18	15	16	13	12	....
28	....	....	18	13	15	14	12	....
29	....	....	16	12	14	14	12	....
30	....	....	16	12	13	16	12	....
31	....	....	18	....	13	16	....	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	4	18	18	12	20	18	16	9	24	18	17	10	19
2	5	16	17	12	20	19	17	11	24	18	18	10	20
3	5	14	18	12	20	20	18	16	25	19	17	10	22
4	4	11	18	11	22	20	19	15	25	20	16	10	22
5	7	12	18	11	22	20	20	14	25	20	15	10	21
6	12	12	18	12	21	18	21	13	25	16	15	10	21
7	10	10	18	12	20	18	22	14	24	16	14	10	18
8	10	16	18	12	20	21	23	14	22	16	14	12	17
9	10	17	17	14	19	21	24	14	23	17	15	11	15
10	10	18	17	14	17	20	25	13	25	19	18	13	14
11	9	20	17	13	14	22	26	16	25	18	22	15	13
12	8	18	16	13	14	22	27	14	25	17	22	20	13
13	8	20	16	14	13	22	28	14	24	15	22	20	12
14	8	22	19	15	12	19	29	18	24	12	21	20	12
15	9	23	19	17	11	18	30	20	24	12	20	20	13
							31	......	21	......	20	21	......

NOTE.—1915: Recording gage clock stopped, discharge estimated from range of stage recorded; Apr. 28 to May 16, 16 sec.-ft.; Oct. 13–22, 14 sec.-ft. 1916: No gage-height record, discharge interpolated, May 1–2, June 8–12, and 27.

Monthly discharge of Mitchell Slough canal near Junction, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean)	Run-off (total in acre-feet).
1914.			1916.		
October 1-22	11.5	502	April	11.1	660
			May	20.4	1,250
1915.			June	17.2	1,020
April 26-30	15.6	154	July	15.5	946
May	17.4	1,070	August	15.7	959
June	15.1	898	September	18.3	1,090
July	11.9	732			
August	11.5	707			
September	15.3	910			
October 1-23	13.7	624			

JUNCTION MIDDLE CANAL NEAR JUNCTION, UTAH.

Location.—In NW. ¼ sec. 16, T. 30 S., R. 3 W., 1,000 feet due east of Piute County cheese factory and 800 feet below head of canal, which diverts from Sevier River 2¼ miles southeast of Junction, Piute County.

Records available.—May 17 to September 30, 1915; May 1 to September 30, 1916; some miscellaneous measurements made during 1914.

Gage.—Vertical enamel gage nailed to upstream wing of old wooden flume; read by Andrew Barnson.

Discharge measurements.—Made by wading near gage.

Channel and control.—Earth section. No permanent control. The Barnson spring flows into the canal about 150 feet below the gage, and at times a diversion dam is placed across the canal just below the spring.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation subject to changes due to accumulation of silt and vegetation in channel below gage. Standard rating curve developed, parallel to which curves through various measurements were used. Staff gage read once a day to tenths. Daily discharge ascertained by applying daily gage height to rating table and by shifting-control method. Records fair.

Discharge measurements of Junction middle canal near Junction, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 17	J. J. Sanford	4.18	9.6	Apr. 21	J. J. Sanford	3.86	4.3
June 18	.....do	3.79	3.2	May 3	J. J. Sanford	4.18	3.9
July 14	Porter and Sanford	4.03	6.3	11	.....do	4.14	8.5
27	J. J. Sanford	4.28	8.5	18	.....do	4.47	11.4
Aug. 10	.....do	3.92	5.5	June 13	.....do	3.78	3.0
23	.....do	3.84	3.7	July 10	.....do	4.04	5.7
				28	.....do	4.10	1.6
				Sept. 11	.....do	4.12	4.8

Daily discharge, in second-feet, of Junction middle canal near Junction, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1915.						1915.					
1		1.8	9.8	4.3	3.2	16		0	7.3	3.4	2.6
2		5.2	11	4.3	3.2	17	9.6	0	7.1	3.2	4.5
3		4.7	8.9	3.9	3.4	18	9.2	3.3	1.5	3.1	4.5
4		8.6	8.4	2.0	3.1	19	6.2	9.8	1.4	3.1	5.4
5		2.1	8.4	4.8	3.1	20	6.0	9.8	1.2	2.9	5.2
6		5.2	8.4	4.2	2.9	21	5.5	7.4	1.2	2.9	5.2
7		4.3	8.4	4.2	2.9	22	5.1	6.3	6.3	3.1	3.9
8		4.5	7.3	5.2	2.6	23	5.3	5.2	8.6	3.4	3.8
9		1.8	12	5.2	2.8	24	5.1	3.4	1.1	2.9	3.4
10		.1	13	6.2	2.9	25	4.7	.4	6.3	2.9	3.6
11		3.4	7.3	6.2	2.1	26	3.5	0	8.1	2.8	3.4
12		1.8	7.3	6.0	1.8	27	0	4.8	8.4	2.6	2.1
13		2.6	6.9	5.2	3.2	28	0	4.6	8.4	2.8	3.4
14		1.8	7.1	5.2	3.2	29	0	4.2	8.1	2.9	1.8
15		1.2	7.3	5.2	2.1	30	0	2.4	7.4	2.9	1.8
						31	4.0		7.4	3.1	

Daily discharge, in second-feet, of Junction middle canal near Junction, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1916.						1916.					
1	4	2	6	1	1	16	9	2	3	0	3
2	4	2	6	1	2	17	5	2	3	0	1
3	4	2	8	1	1	18	4	0	3	0	1
4	15	2	9	1	1	19	2	3	1	0	1
5	10	2	9	1	2	20	1	5	1	0	1
6	13	5	8	2	2	21	9	4	0	0	1
7	14	5	7	1	2	22	5	4	0	0	1
8	0	5	8	1	3	23	5	2	2	0	1
9	0	3	9	1	5	24	1	2	1	0	1
10	14	2	7	1	3	25	1	6	1	0	1
11	8	3	5	1	5	26	9	10	1	0	1
12	7	2	3	1	4	27	6	12	7	0	1
13	4	2	3	1	4	28	6	10	2	1	1
14	2	2	0	0	3	29	5	7	0	0	1
15	13	2	3	0	3	30	5	6	2	1	1
						31	4	......	2	1	......

Monthly discharge of Junction middle canal near Junction, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
May 17-31	4.3	127	May	6.1	375
June	3.7	220	June	3.9	230
July	7.1	439	July	3.8	236
August	3.9	238	August	.6	34
September	3.2	193	September	1.9	115
The period	....	1,220	The period	....	990

EAST FORK OF SEVIER RIVER AT COYOTO, UTAH.

Location.—In the NW. ¼ sec. 15, T. 31 S., R. 2 W., immediately below mouth of Coyoto Creek, half a mile below diversion to Otter Creek reservoir, and about half a mile southeast of schoolhouse at Coyoto, Garfield County.

Drainage area.—Not measured.

Records available.—December 7, 1914, to August 15, 1915; August 1 to September 30, 1916. October 28, 1915, to August 31, 1916, a station was maintained about 4 miles below, but the flow is not comparable at these two points due to return flow between the stations.

Gage.—Vertical staff on right bank July 30 to September 30, 1916, and March 12 to August 15, 1915. Original gage vertical staff on left bank fastened to old bridge abutment just above present gage; different datum. Gage reader, Mazle King.

Discharge measurements.—Made by wading near station.

Channel and control.—One channel at all stages; stream bed sand and gravel, shifting at high stages.

Extremes of discharge.—Not determined; record fragmentary.

Ice.—No record during winter.

Diversions.—Canals divert for irrigation and storage above the station.

Regulation.—None other than diversions above mentioned.

Accuracy.—Stage-discharge relation unchanged from August 1 to September 30, 1916. Rating curve fairly well defined by measurements made during this period and the first part of the climatic year 1917. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of East Fork of Sevier River at Coyoto, Utah, during the year ending Sept. 30, 1916.

[Made by J. J. Sanford.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 30	1.50	61
Aug. 21	.64	4.4
Sept. 14	.80	9.7

Daily discharge, in second-feet, of East Fork of Sevier River at Coyoto, Utah, for the year ending Sept. 30, 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	52	10	11	7	10	21	7	4
2	52	10	12	7	10	22	10	4
3	186	7	13	7	10	23	7	4
4	160	7	14	10	10	24	7	7
5	186	7	15	7	7	25	7	7
6	300	7	16	7	7	26	7	7
7	213	10	17	7	7	27	7	4
8	80	13	18	7	4	28	7	3
9	52	24	19	7	4	29	7	3
10	52	10	20	7	4	30	10	10
						31	13	....

Monthly discharge of East Fork of Sevier River at Coyoto, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
August	48.2	2,960
September	7.7	458
The period	....	3,420

EAST FORK OF SEVIER RIVER ABOVE OTTER CREEK, NEAR COYOTO, UTAH.

Location.—In W. ½ sec. 28, T. 30 S., R. 2 W., just above Otter Creek reservoir outlet, about 5 miles northwest of Coyoto, Garfield County, and 12 miles east of Kingston, Piute County.

Drainage area.—Not measured.

Records available.—November 1, 1915, to August 31, 1916. Station discontinued.

Gage.—Vertical staff on right bank, read by Delbert Moore.

Discharge measurements.—Made by wading near gage or from bridge at gage.

Channel and control.—Bed composed of sand and clay; shifting. Water overflows banks at high stages.

Ice.—Stage-discharge relation affected by ice.

Diversions.—Coyoto canal and Otter Creek reservoir feeder canal divert above station.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent; affected by ice in winter and backwater from Otter Creek reservoir outlet in summer. Several shifts in control occurred during the period of records. Rating curves poorly defined. Gage read to tenths once daily. Daily discharge determined by applying daily gage height to rating tables, by shifting control method, and by estimate. Records poor.

Discharge measurements of East Fork of Sevier River above Otter Creek, near Coyoto, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	J. J. Sanford	8.50	48.4	Apr. 20	J. J. Sanford	8.65	160
Dec. 6	A. B. Purton	8.59	57	May 20	.....do	7.55	41.1
Jan. 28	J. J. Sanford	7.50	21.6	June 2	.....do	7.20	23.1
Feb. 29	.....do	6.91	10.8	27	.....do	*a* 7.75	3.9
Mar. 31	.....do	8.00	89				

a Backwater.

Daily discharge, in second-feet, of East Fork of Sevier River above Otter Creek, near Coyoto, Utah, for the year ending Sept. 30, 1916.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	27		28	21	20	103	255	25	4	
2	27		37	16	25	103	265	25	4	
3	27		41	12	25	114	278	25		
4	27		54	12	15	103	284	25		
5	27		39	13	15	103	290	20		
6	27	57	40	13	15	82	296	20		
7	34	53	48	41	20	82	260	15		
8	27	49	57	56	20	92	235	15		
9		45	58	65	10	92	210	15		
10		41	59	104	25	92	196	15		
11		36	43	84	30	103	180	10		20
12		31	44	22	25	103	166	7		20
13		32	38	17	20	114	152	3		20
14		34	38	22	49	126	126	2		20
15			39	34	92	126	103	2		22
16	27		33	24	82	114	65	2		25
17	27		74	24	15	114	49	1		25
18	27		66	35	30	126	42	0		25
19	27	36	50	20	42	126	36	0		28
20	27	49	35	20	42	126	36	0		30
21	27	62	44	21	82	139	36	0		30
22	27	53	53	22	114	139	30	0		28
23	27	54	71	12	139	152	30	0		25
24	27	55	73	8	210	174	30	0		25
25		52	75	8	103	195	30	2		25
26		49	77	9	82	202	30	4		25
27		57	48	10	92	210	30	4		25
28		67	18	10	103	225	30	4		25
29		46	42	15	92	239	30	4		49
30		36	30		103	243	30	4		42
31		27	24		114		30			25

NOTE.—Discharge estimated on account of ice: Nov. 9–15, 28 second-feet; Nov. 25–30, 30 second-feet Dec. 1–5, 45 second-feet; Dec. 15–18, 35 second-feet. Stream dry June 18–24. Discharge estimated on account of backwater: June 25, 2 second-feet; June 26 to July 23, 4 second-feet; July 24–31, 50 second-feet; and Aug. 1–10, 110 second-feet. Discharge interpolated Nov. 23, Dec. 7, 9, 11, 13, 23, 25, 30, Jan. 14, 17, 19, 21, 24, 27, Feb. 2, Apr. 24, 26, 28, 29, May 1, 2, 4, 5, 8, 10, and 12.

Monthly discharge of East Fork of Sevier River above Otter Creek, near Coyoto, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November	34		28.1	1,670
December	67		44.7	2,750
January	77	18	49.2	3,030
February	104	8	26.6	1,530
March	210	10	59.7	3,670
April	243	82	135	8,030
May	296	30	124	7,620
June	25	0	8.3	490
July			15.9	980
August			53.5	3,290
The period				33,100

EAST FORK OF SEVIER RIVER NEAR KINGSTON, UTAH.

Location.—In SW. ¼ sec. 13, T. 30 S., R. 3 W., about a mile below highway bridge and 2 miles east of Kingston, Piute County.

Drainage area.—1,260 square miles (measured on topographic maps).

Records available.—April 29, 1914, to September 30, 1916. Records obtained about 1½ miles above Rockyford bridge, in the SW. ¼ sec. 16, T. 30 S., R. 2½ W., March 27, 1913, to April 28, 1914; also at gage three-fourths of a mile north of Kingston, in the NE. ¼ sec. 10, T. 30 S., R. 3 W., May 11 to September 20, 1912.

Gage.—Stevens continuous water-stage recorder on right bank, 1 mile below highway bridge, April 24, 1914, to September 30, 1916; vertical staff 1½ miles above bridge March 27, 1913, to April 28, 1914.

Discharge measurements.—Made from cable, highway bridge, or by wading.

Channel and control.—Stream bed is composed of gravel; shifts during floods. One channel at medium and low stages. Right bank is overflowed in high water.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 4.40 feet at 3 p. m. August 1 (discharge, 660 second-feet); minimum stage, 2.23 feet at 7 p. m. September 19 (discharge, 16 second-feet).

1913–1916: Maximum stage recorded, 4.40 feet August 1, 1916 (discharge, 660 second-feet); minimum stage, 1.00 foot September 19, 20, and 21, 1913 (discharge, 8 second-feet).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Present station above all diversions in vicinity of Kingston; original site below all diversions.

Regulation.—Flow affected by operation of gates in the Otter Creek reservoir dam 8 miles above.

Accuracy.—Stage-discharge relation permanent until July 28, when a sudden rise scoured out the control; affected by ice during December, January, and February. Rating curve used October 1 to July 28 well defined; parallel curves used for rest of year. Operation of water-stage recorder satisfactory throughout year. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except for periods of shift, for which shifting-control method was used and for period of ice effect. Records good.

Discharge measurements of East Fork of Sevier River near Kingston, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 28	J. J. Sanford	2.80	52	June 3	J. J. Sanford	2.85	59
Dec. 5	A. B. Purton	2.86	56	27	.....do	3.73	286
Jan. 27[a]	J. J. Sanford	2.70	18.9	July 12	.....do	3.84	325
Feb. 28	.....do	2.58	28.5	28	.....do	4.60	461
Mar. 30	.....do	3.22	146	Aug. 8	.....do	4.06	512
Apr. 20	Sanford and Jacob	3.56	206	10	.....do	3.40	205
May 2	J. J. Sanford	3.82	316	21	.....do	2.38	26.9
12	.....do	3.84	325	Sept. 13	.....do	2.42	20.3
20	.....do	3.04	72				

[a] Frozen over at gage and control.

Daily discharge, in second-feet, of East Fork of Sevier River near Kingston, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	49	50	......	27	120	385	52	317	427	26
2	23	29	49	......	26	112	327	51	317	435	25
3	23	26	29	......	25	115	313	51	317	440	25
4	26	24	30	......	26	122	299	49	317	440	25
5	26	23	58	......	41	122	299	49	317	450	23
6	25	23	58	......	41	112	308	49	317	450	23
7	25	25	55	......	32	103	327	48	317	507	22
8	26	27	33	......	29	99	355	48	317	468	22
9	26	27	30	......	29	105	355	48	322	277	24
10	25	28	29	......	35	108	346	46	327	209	22
11	23	28	29	41	33	108	341	46	327	181	22
12	34	27	29	40	30	152	322	45	327	163	22
13	33	27	28	33	36	130	262	43	327	151	21
14	33	35	28	31	60	130	180	43	327	154	20
15	33	39	28	31	33	135	138	40	327	154	19
16	31	29	24	33	29	148	99	38	336	154	18
17	22	28	......	35	33	170	80	38	327	151	17
18	22	28	......	35	44	218	73	38	317	125	17
19	21	27	......	35	47	230	72	108	317	42	17
20	22	27	......	36	55	215	76	128	317	27	26
21	21	29	......	32	70	197	73	130	317	27	193
22	21	29	......	29	105	200	68	130	317	27	249
23	21	31	......	29	130	215	66	132	317	26	249
24	23	29	......	28	170	234	62	135	317	25	245
25	22	26	......	27	132	258	61	246	322	24	249
26	52	25	......	27	120	294	58	271	341	23	257
27	53	26	......	29	125	332	56	275	385	28	253
28	49	25	......	30	140	370	53	299	445	27	253
29	49	35	......	28	148	405	53	308	453	28	253
30	49	50	......	......	135	405	53	313	441	28	253
31	49	......	......	......	120	......	53	......	430	26	......

NOTE.—Discharge interpolated because of broken gage-height record, Aug. 2-5, 19, and 20. Stage-discharge relation affected by ice Dec. 17 to Feb. 10. Discharge estimated as follows: Dec. 17-31, 22 second-feet; Jan. 1-31, 20 second-feet; Feb. 1-5, 30 second-feet; Feb. 6-10, 40 second-feet.

Monthly discharge of East Fork of Sevier River near Kingston, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off total (in acre-feet).
	Maximum.	Minimum.	Mean.	
October	53	21	30.1	1,850
November	50	23	29.4	1,750
December	58	....	29.6	1,820
January	....	....	20.0	1,230
February	41	....	33.1	1,900
March	170	25	67.9	4,180
April	405	99	189	11,200
May	385	53	181	11,100
June	313	38	110	6,550
July	453	317	339	20,800
August	507	23	184	11,300
September	257	17	96.3	5,730
The year	507	17	109.5	79,400

COYOTO CANAL NEAR COYOTO, UTAH.

LOCATION.—About half a mile west of Riddle ranch house, half a mile south of mouth of Antimony Creek, and about 3 miles south of Coyoto, Garfield County.

RECORDS AVAILABLE.—July 30 to September 30, 1916.

GAGE.—Vertical staff on left bank; read by Douglas Riddle.

DISCHARGE MEASUREMENTS.—Made from footbridge.

CHANNEL AND CONTROL.—Earth channel; fairly permanent.

DIVERSIONS.—None above gage.

REGULATION.—Flow controlled by headgates.

ACCURACY.—Stage-discharge relation permanent during season. Rating curve not fully developed. Staff gage read once each day. Daily discharge ascertained by applying daily gage height to rating table. Records poor.

Discharge measurements of Coyoto canal near Coyoto, Utah, during the year ending Sept. 30, 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 30	5.30	16.8
Aug. 21	4.97	10.1
Sept. 14	5.01	8.8

Daily discharge, in second-feet, of Coyoto canal near Coyoto, Utah, for the year ending Sept. 30, 1916.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	......	17	13	11	......	0	10	21	......	16	8
2	......	19	13	12	......	0	10	22	......	16	8
3	......	29	10	13	......	0	10	23	......	14	8
4	......	26	8	14	......	0	10	24	......	12	6
5	......	24	8	15	......	0	10	25	......	8	6
6	......	19	8	16	......	8	10	26	......	10	6
7	......	1	8	17	......	8	8	27	......	10	6
8	......	0	8	18	......	10	8	28	......	12	6
9	......	0	10	19	......	10	8	29	......	18	6
10	......	0	10	20	......	8	8	30	17	17	6
								31	17	16	......

Monthly discharge of Coyoto canal near Coyoto, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
August	10.5	646
September	8.5	504

OTTER CREEK ABOVE RESERVOIR, NEAR COYOTO, UTAH.

Location.—In sec. 25, T. 29 S., R. 2 W., three-quarters of a mile above Otter Creek reservoir and 10 miles north of Coyoto, Garfield County.

Drainage area.—Not measured.

Records available.—January 17 to August 10, 1915; October 1, 1915, to September 30, 1916.

Gage.—Vertical staff on right bank; read by Nelo Brindley.

Discharge measurements.—Made by wading near gage.

Channel and control.—Bed of stream composed of sand and gravel. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 4.08 feet at 8 a. m. March 12 (discharge, 87 second-feet); minimum stage recorded, −0.17 foot August 10 to September 8 (discharge, 0.6 second-foot).

1915–1916: Maximum stage recorded March 12, 1916; no flow August 10, 1915.

Ice.—Stage-discharge relation affected by ice.

Diversions.—Canals taken out for irrigation upstream.

Regulation.—One reservoir storing water for irrigation upstream; capacity unknown.

Accuracy.—Stage-discharge relation changed during winter, permanent thereafter. Rating curve for spring and summer period well defined below 50 second-feet; for period October to December, a parallel curve through measurement made December 6. Staff gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Otter Creek above reservoir, near Coyoto, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 6	A. B. Purton	1.68	27.2	May 2	J. J. Sanford	1.66	30.00
Jan. 28	J. J. Sanford	[a] 2.48	6.3	June 2	.....do	−.12	.82
Feb. 29	.....do	2.45	49.0	July 30	.....do	−.15	.96
Mar. 31	.....do	1.66	33.2	Sept. 15	.....do	+.22	4.3
Apr. 21	.....do	1.14	20.9				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Otter Creek above reservoir, near Coyoto, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4	11	23	......	53	33	39	3	0.7	1	0.6
2	4	12	24	......	55	44	40	1	.7	5	.6
3	5	12	27	......	61	43	35	1	.7	7	.6
4	5	11	24	......	53	44	30	1	.7	7	.6
5	5	11	26	......	54	42	37	0.9	.7	7	.6
6	4	12	28	......	56	40	40	.9	.7	7	.6
7	4	28	32	......	68	39	45	.9	.7	7	.6
8	4	29	24	......	69	38	60	.9	.7	6	.6
9	4	25	31	......	71	36	58	.9	.7	6	4
10	4	23	24	......	83	36	56	.9	.7	0.6	4
11	4	22	27	......	90	36	57	.9	.7	.6	4
12	4	21	26	......	92	36	56	.9	.7	.6	4
13	4	23	23	......	90	36	45	.9	.7	.6	4
14	4	26	23	......	83	34	39	.9	.7	.6	5
15	4	56	26	......	84	34	30	.9	.7	.6	4
16	4	53	......	......	82	22	27	.9	.6	.6	5
17	4	33	......	......	77	23	30	.9	.6	.6	7
18	4	52	......	52	72	20	28	.9	.6	.6	7
19	4	24	......	44	64	19	27	.9	.6	.6	7
20	4	26	......	47	60	18	31	.9	.6	.6	7
21	4	27	......	54	63	18	18	.9	.6	.6	7
22	4	27	......	54	66	14	13	.9	.6	.6	7
23	4	30	......	52	74	11	13	.9	.6	.6	7
24	4	30	......	55	72	11	12	.9	.6	.6	2
25	5	34	......	58	71	14	11	.9	.6	.6	2
26	10	20	......	58	67	14	7	.9	.6	.6	2
27	11	18	......	56	64	16	5	.9	.6	.6	2
28	12	11	......	54	52	18	5	.9	.6	.6	2
29	12	44	......	52	47	36	5	.9	.6	.6	2
30	12	28	......	......	38	38	4	.9	.6	.6	2
31	12	......	......	......	32	......	4	......	.6	.6	......

NOTE.—Discharge estimated because of ice: Dec. 16–31, 25 second-feet; Jan. 1–10, 15 second-feet; 11–20, 10 second-feet; 21–31, 6 second-feet; Feb. 1–17, 30 second-feet.

Monthly discharge of Otter Creek above reservoir, near Coyoto, Utah, for the year ending Sept 30, 1916.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	5.6	343	May	29.3	1,800
November	26.0	1,550	June	1.0	58
December	25.4	1,560	July	.6	40
January	10.2	627	August	2.1	131
February	39.5	2,270	September	4.3	254
March	66.5	4,090			
April	28.8	1,710	The year	....	14,400

OTTER CREEK NEAR COYOTO, UTAH.

Location.—In W. ½ sec. 28, T. 30 S., R. 2 W., just below outlet of Otter Creek reservoir, 5 miles northwest of Coyoto, Garfield County, and about 12 miles east of Kingston, Piute County.

Drainage area.—Indeterminate; 400 square miles of Otter Creek basin tributary to reservoir, which receives also water from East Fork of Sevier River.

Records available.—June 21, 1913, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on left bank, with outside staff gage.

Discharge measurements.—Made by wading just below gage.

Channel and control.—Bed composed of gravel. One channel at all stages. Broad-crested concrete weir just below gage serves as permanent control.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 2.41 feet July 12, 13, 20, 23, and 24 (discharge, 328 second-feet); outlet gates closed during nonirrigation season and a flow of between 1 and 2 second-feet is maintained by seepage.

1913–1916: Maximum stage recorded, 2.67 feet at 3 a. m. July 4, 1914 (discharge, 393 second-feet); minimum flow 1 or 2 second-feet seepage when gates at dam are closed.

Winter flow.—Gates of reservoir usually closed. See preceding paragraph.

Diversions.—Some diversions for irrigation above reservoir.

Regulation.—Flow past station controlled by operation of outlet gates of reservoir.

Accuracy.—Stage-discharge relation permanent. Rating curve very well defined below 400 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Discharge measurements of Otter Creek near Coyoto, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 6	A. B. Purton	0.24	[a] 1
June 27	J. J. Sanford	2.10	264
July 12	....do	2.41	323

[a] Estimated.

Daily discharge, in second-feet, of Otter Creek near Coyoto, Utah, for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1		11	316	318	6	16		15	324	156	4
2		13	313	316	6	17		15	322	157	4
3		12	313	316	6	18		39	322	64	5
4		12	313	318	6	19		115	324	21	12
5		12	311	270	6	20		118	328	15	50
6		12	313	192	6	21		119	326	9	228
7		12	318	152	6	22		121	326	8	246
8		12	318	152	6	23		119	328	7	244
9		12	318	150	5	24		172	328	6	242
10		14	316	150	5	25		270	326	6	244
11		15	324	150	4	26	11	266	326	6	246
12		15	328	150	4	27	11	282	324	6	244
13		15	328	150	4	28	11	322	322	6	244
14		14	326	154	5	29	11	318	322	6	242
15		12	326	156	4	30	10	316	322	6	244
						31	10		320	6	

Note.—Reservoir gates opened May 26. During winter period gates are closed, but a seepage flow of about 2 second-feet passes the station.

Monthly discharge of Otter Creek near Coyoto, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
May	3.7	226	August	115	7,070
June	93.3	5,550	September	85.9	5,110
July	322	19,800			

OTTER CREEK RESERVOIR FEEDER CANAL AT HEAD, NEAR COYOTO, UTAH.

Location.—In NW. ¼ sec. 15, T. 31 S., R. 2 W., just below passage of unnamed wash over canal and about half a mile southwest of schoolhouse at Coyoto, Garfield County.

Records available.—December 8, 1914, to July 28, 1915, and August 1, to September 30, 1916.

Gage.—Vertical staff on right bank fastened to old bridge abutment August 1 to September 30, 1916. Original gage used December 8, 1914, to July 28, 1915, vertical staff fastened to left abutment of same bridge. Gage reader, Mazle King.

Discharge measurements.—Made by wading or from plank across flume.

Channel and control.—One channel at all stages. Control practically permanent; affected slightly by moss growth in summer.

Extremes of discharge, 1914–15, 1916: Maximum stage recorded, 3.4 feet, May 8, 1915 (discharge, 225 second-feet). Minimum stage, canal dry, April 12–23, 1915.

Ice.—None.

Diversions.—None above station.

Regulation.—Flow in canal regulated by head gates.

Accuracy.—Stage-discharge relation not permanent. Several fairly well defined rating curves used for 1915; for 1916 fairly well defined curve developed from one measurement made during period of records and several made during climatic year 1917. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height direct to rating table and by shifting-control methods. Records fair.

Canal diverts water from East Fork of Sevier River in SW. ¼ sec. 15, T. 31 S., R. 2 W., for storage in Otter Creek reservoir.

Discharge measurements of Otter Creek reservoir feeder canal at head, near Coyoto, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1914.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Dec. 8	1.85	53	May 16	3.20	184	July 30	2.44	82
			June 1	3.02	151	Aug. 21	2.26	60
1915.			18	1.88	50	Sept. 14	2.05	43
Jan. 17	1.88	64	July 3	1.59	26			
Mar. 12	1.80	55	20	1.64	28			
Apr. 27	2.90	169						

Daily discharge, in second-feet, of Otter Creek reservoir feeder canal at head, near Coyoto, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1914–15.								
1	....	55	55	68	73	174	148	34
2	....	55	60	68	78	180	140	26
3	....	60	60	68	93	180	131	26
4	....	55	60	64	114	186	128	30
5	....	55	55	64	114	191	124	30
6	....	55	55	64	120	202	120	30
7	....	55	60	60	125	202	115	30
8	54	55	64	55	136	225	108	26
9	54	55	64	55	134	210	100	26
10	54	55	60	60	147	190	95	26
11	49	60	60	55	147	185	90	26
12	49	60	60	55	0	196	85	26
13	44	60	60	55	0	185	80	26
14	40	60	60	60	0	185	80	22
15	40	64	60	60	0	185	60	22
16	40	64	60	60	0	190	51	22
17	36	64	64	64	0	185	42	22
18	36	64	64	64	0	185	41	18
19	32	64	64	64	0	185	34	18
20	38	68	64	64	0	190	34	18
21	42	68	64	64	0	190	34	18
22	43	68	64	64	0	185	34	18
23	51	68	68	68	0	185	34	18
24	44	68	71	68	164	174	34	18
25	44	64	68	68	169	185	34	18
26	48	64	68	73	174	175	34	18
27	49	60	68	73	174	170	34	18
28	54	64	66	68	191	165	34	30
29	60	64	....	73	180	150	34	....
30	60	68	....	73	174	150	34	....
31	60	64	....	73	....	150	....	....

Day.	Oct.	Nov.	Aug.	Sept.	Day.	Oct.	Nov.	Aug.	Sept.
1915–16.					1915–16.				
1	34	41	48	48	16	34	....	90	44
2	34	41	90	48	17	34	....	77	44
3	34	41	175	57	18	41	....	66	44
4	34	41	90	57	19	41	....	66	44
5	34	41	48	48	20	41	....	66	44
6	34	41	215	48	21	41	....	66	44
7	34	41	41	57	22	41	....	66	44
8	34	41	66	77	23	41	....	66	34
9	34	34	120	104	24	41	....	77	34
10	34	34	77	44	25	0	....	77	34
11	34	22	120	44	26	0	....	77	34
12	34	....	120	44	27	0	....	66	34
13	34	....	104	44	28	0	....	66	41
14	34	....	137	44	29	0	....	77	57
15	34	....	104	44	30	0	....	66	77
					31	0	....	48	....

Monthly discharge of Otter Creek reservoir feeder canal at head, near Coyoto, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1914-15.				
December 8-31	60	32	46.7	2,220
January	68	55	61.4	3,780
February	71	55	62.4	3,470
March	73	55	64.3	3,950
April	191	0	83.6	4,970
May	225	150	184	11,300
June	148	34	71.5	4,250
July 1-28	34	18	23.6	1,310
The period				35,250
1915-16.				
October	41	0	27.9	1,720
November 1-11	41	22	38.0	829
August	215	48	86.2	5,300
September	104	34	48.7	2,900

OTTER CREEK RESERVOIR FEEDER CANAL AT MOUTH, NEAR COYOTO, UTAH.

Location.—In sec. 22, T. 30 S., R. 2 W., just above point where canal discharges into reservoir, about 4 miles north of Coyoto, Garfield County.

Records available.—July 29 to August 15, 1915, and November 12, 1915, to September 30, 1916.

Gage.—Vertical staff fastened to left side of rating flume; read by Delbert Moore.

Discharge measurements.—Made from plank across flume.

Channel and control.—Artificial earth channel; rating flume forms a permanent control.

Extremes of discharge, 1915-16.—Maximum stage recorded, 2.9 feet, March 23 and 24, 1916 (discharge, 219 second-feet); canal dry for short periods in October, November, and December, 1915

Ice.—None.

Diversions.—Some water diverted from this canal in vicinity of Coyoto for irrigation.

Regulation.—Flow in canal regulated by head gates.

Accuracy.—Stage-discharge relation not permanent; changed in March and again in August, 1916; slight changes at various times due to collection of debris in flume. Standard rating curve well defined. Gage read each day to tenths. Daily discharge ascertained by applying daily gage height direct to rating table, and by shifting-control method. Records fair.

This canal diverts water from East Fork of Sevier River, in SW. ¼ sec. 15, T. 31 S., R. 2 W., near Coyoto, for storage in Otter Creek reservoir.

Discharge measurements of Otter Creek reservoir feeder canal at mouth, near Coyoto, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
July 29	J. J. Sanford	1.12	20.5	May 3	J. J. Sanford	1.84	79
Dec. 6	A. B. Purton	.89	7.4	May 20	.....do	2.30	141
				June 2	.....do	1.60	60
1916.				27	.....do	.80	5.4
Jan. 28	J. J. Sanford	1.40	48	July 12	.....do	1.14	19.3
Feb. 29	.....do	1.48	58	30	.....do	1.72	71
Mar. 31	.....do	2.20	124	Aug. 21	.....do	1.54	55
Apr. 20	.....do	2.25	137	Sept. 14	.....do	1.42	38

Daily discharge, in second-feet, of Otter Creek reservoir feeder canal at mouth, near Coyoto, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	July.	Aug.	Day.	July.	Aug.	Day.	July.	Aug.
1915.			1915.			1915.		
1	......	22	11	......	14	21	......	......
2	......	22	12	......	12	22	......	......
3	......	22	13	......	12	23	......	......
4	......	22	14	......	12	24	......	......
5	......	22	15	......	14	25	......	......
6	......	23	16	......	......	26	......	......
7	......	25	17	......	......	27	......	......
8	......	25	18	......	......	28	......	......
9	......	20	19	......	......	29	21	......
10	......	14	20	......	......	30	23	......
						31	23	......

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.											
1	......	0	43	48	74	162	92	64	10	92	38
2	......	0	43	48	80	148	86	58	10	80	38
3	......	0	38	48	81	148	86	58	10	69	38
4	......	0	35	48	52	143	74	58	12	80	36
5	......	0	44	48	51	150	74	53	14	104	35
6	......	8	44	48	56	150	86	53	14	207	33
7	......	8	44	92	55	156	111	48	17	155	30
8	......	38	44	80	60	164	150	48	17	129	30
9	......	38	45	104	65	158	163	48	17	129	34
10	......	39	40	86	76	145	202	48	17	129	38
11	......	39	36	90	74	138	203	38	20	122	38
12	48	39	36	69	86	139	210	17	20	116	38
13	38	39	40	48	97	146	210	14	20	104	38
14	38	36	36	53	97	139	152	12	23	98	38
15	38	32	36	48	108	165	139	10	38	92	38
16	38	22	46	52	108	167	139	8	38	80	38
17	38	13	46	52	111	154	141	8	38	69	38
18	38	13	46	54	112	154	141	8	38	64	36
19	38	32	47	48	182	154	134	8	38	58	36
20	38	41	47	48	130	155	136	6	43	58	35
21	38	41	47	53	116	162	104	6	43	53	34
22	38	32	47	58	116	167	92	6	43	50	34
23	38	41	47	64	219	160	86	6	48	48	34
24	38	41	48	64	219	159	74	6	48	48	34
25	34	42	48	69	78	159	73	6	53	48	25
26	38	33	48	64	67	151	72	6	58	38	32
27	38	37	48	64	88	145	72	5	69	38	32
28	0	42	48	64	100	137	69	5	110	43	30
29	0	42	48	69	124	130	69	5	110	194	30
30	0	43	48	......	150	98	69	10	116	104	30
31	......	43	48	......	155	......	69	......	129	38	......

NOTE.—No gage height record, discharge interpolated: Dec. 14, 16; Aug. 9, 11, 14, 16, 18, and 22.

Monthly discharge of Otter Creek reservoir feeder canal at mouth, near Coyoto, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 12–30	48	0	32.5	1,220
December	43	0	28.2	1,730
January	48	35	43.9	2,700
February	104	48	61.4	3,530
March	219	51	103	6,330
April	167	98	150	8,930
May	210	69	115	7,070
June	64	5	24.2	1,440
July	129	10	41.3	2,540
August	207	38	88.3	5,430
September	38	30	34.9	2,080

KINGSTON CANAL AT KINGSTON, UTAH.

Location.—In NE. ¼ sec. 15, T. 30 S., R. 3 W., 300 feet below head of canal, at east edge of Kingston, Piute County, on road to Coyoto.

Records available.—May 15, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder, with inside and outside staff gages.

Discharge measurements.—Made by wading 75 feet above gage.

Channel and control.—Bed composed of gravel. Crest of combination concrete weir dividing box in canal just below gage serves as control. Stage discharge relation affected at times during 1915 by movement of the dividing blade; permanent during 1916 season.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed at times during 1915; permanent during 1916 season. Rating curves well defined. Operation of water-stage recorder satisfactory throughout each season except for short periods as indicated in footnote to table of daily discharge. Daily discharge ascertained by shifting-control method and by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records for 1915 good; for 1916, excellent.

Canal diverts water from left bank of East Fork of Sevier River in the NW. ¼ sec. 14, T. 30 S., R. 3 W. Water used for irrigation near Kingston.

Discharge measurements of Kingston canal at Kingston, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 4	J. J. Sanford	1.36	29.3	May 2	J. J. Sanford	1.38	32.2
29	do	1.65	41.4	12	do	1.39	32.2
June 18	do	1.20	22.0	June 12	do	1.27	26.3
July 3	Sanford and Jones	.62	3.7	27	do	1.36	28.7
16	Porter and Sanford	1.38	31.7	Aug. 10	do	.98	14.5
Aug. 10	J. J. Sanford	1.22	25.1	Sept. 13	do	1.00	15.4
25	Sanford and Jones	.55	1.9				

Daily discharge, in second-feet, of Kingston canal at Kingston, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	10	9	10	17	14
2	9	10	11	18	15
3	9	11	11	19	16
4	10	12	12	20	16
5	10	13	12		
6	9	14	12		
7	10	15	13		
8	10	16	14		

Daily discharge, in second-feet, of Kingston canal at Kingston, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1915.							1915.						
1	......	37	26	21	10	14	16	31	28	31	25	17	......
2	17	37	14	23	10	17	17	30	24	30	24	17	......
3	21	35	3.5	18	10	18	18	29	22	30	19	17	......
4	27	30	3.5	16	10	19	19	28	20	22	12	17	......
5	28	9.8	18	16	11	20	20	28	19	12	16	17	......
6	28	5.5	31	16	13	20	21	27	23	21	10	17	......
7	26	7.0	31	16	13	......	22	27	26	25	9.7	17	......
8	25	12	31	16	17	......	23	20	22	24	16	17	......
9	22	17	31	16	18	......	24	16	20	14	17	13	......
10	22	23	32	22	18	......	25	16	20	14	6.7	8	......
11	23	26	32	24	18	......	26	16	25	14	2	8	......
12	22	28	21	24	18	......	27	16	26	15	10	8	......
13	28	28	20	19	18	......	28	27	26	24	15	7.6	......
14	32	28	25	15	18	......	29	41	26	21	15	13	......
15	32	29	31	18	18	......	30	41	26	24	11	17	......
							31	39	......	24	10	......	......

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	34	23	27	24	23	16	14	26	22	1	22	16
2	......	32	24	28	16	24	17	19	24	22	2	22	14
3	......	33	26	26	15	12	18	20	24	22	7	20	13
4	......	32	23	18	16	5	19	20	24	22	16	11	12
5	......	32	26	17	15	3	20	19	24	23	24	6	19
6	......	32	29	17	20	4	21	19	24	24	26	10	13
7	......	18	30	19	20	5	22	19	24	24	26	19	21
8	......	17	32	27	18	7	23	19	24	25	26	16	20
9	......	34	30	30	16	9	24	20	23	26	23	13	20
10	......	34	30	28	17	11	25	20	22	26	14	10	20
11	......	34	29	24	21	13	26	22	23	28	15	13	20
12	......	33	28	23	16	15	27	23	24	32	15	15	19
13	6	32	28	23	15	16	28	30	25	32	19	17	17
14	6	30	27	17	19	15	29	35	26	30	25	18	17
15	10	24	25	3	22	16	30	35	26	28	24	24	17
							31	......	26	......	24	23	......

NOTE.—1915: No gage-height record; discharge interpolated May 18–19, July 2; estimated Oct. 7–15, 20 second-feet; Oct. 16–23, 1 second-foot. 1916: No gage-height record, discharge interpolated, May 26–29, June 19–23, Sept. 6–12.

Monthly discharge of Kingston canal at Kingston, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean)	Run-off (total in acre-feet).
1914.			1916.		
October 1–20	11.7	463	April 13–30	19.8	712
1915.			May	27.1	1,670
May 2–31	26.2	1,560	June	26.5	1,580
June	23.5	1,400	July	19.8	1,220
July	22.4	1,380	August	17.1	1,050
August	16.1	990	September	14.5	863
September	14.4	857			
October 1–23	12.9	587			

CLEAR CREEK AT SEVIER, UTAH.

LOCATION.—In SE. ¼ sec. 32, T. 25 S., R. 4 W., at Sevier, Sevier County, about 100 yards above confluence of stream with Sevier River. Dry Creek enters from the right about 2½ miles above and Mill Creek about 8 miles above the station.

DRAINAGE AREA.—150 square miles (measured on topographic maps).

RECORDS AVAILABLE.—February 23, 1912, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank, April 4, 1914, to September 30, 1916; vertical staff at same site February 23, 1912, to April 3, 1914; both gages at same datum.

DISCHARGE MEASUREMENTS.—Made by wading or from log bridge just above gage.

Channel and control.—Bed composed of sand and gravel. One channel at all stages. Concrete cut-off wall, installed just below gage August 31, 1914, serves as permanent control.

Extremes of discharge.—Maximum stage during year, from water-stage recorder. 2.36 feet at 5 a. m. May 9 (discharge, 153 second-feet); minimum stage, 0.76 foot at noon September 3 (discharge, 2.2 second-feet).

1912–1916: Maximum stage recorded, 3.15 feet May 24, 1914 (discharge, 240 second-feet); stream dry August 26, 1913.

Ice.—Stage-discharge relation not affected by ice except occasionally for short periods.

Diversions.—Cove canal diverts about three-quarters of a mile above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent; not affected by ice during year. Rating curve well defined between zero and 150 second-feet. Operation of water-stage recorder satisfactory except for two short periods in March and April. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Discharge measurements of Clear Creek at Sevier, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 4	A. B. Purton	1.12	16.7	June 5	J. J. Sanford	1.84	82
Jan. 21	J. J. Sanford	1.13	16.4	10	do	2.14	123
Mar. 9	do	1.39	35.6	22	do	1.70	66
25	do	1.48	44.8	July 8	do	1.57	50
Apr. 19	do	1.72	73	21	do	1.19	20.1
29	do	2.20	128	Aug. 15	do	1.06	13.2
May 26	do	1.74	67	Sept 15	do	.82	3.4

Daily discharge, in second-feet, of Clear Creek at Sevier, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.2	7.2	14.0	12.5	13.5	21.0	64	103	84	60	18.6	2.6
2	6.8	6.8	14.0	15.0	15.0	18.0	63	64	79	62	15.0	2.5
3	6.4	7.6	15.6	15.6	18.0	20.4	62	56	77	55	31.2	2.6
4	6.4	6.4	16.2	15.6	18.6	26.6	59	56	79	48	50.0	3.0
5	6.8	5.1	16.2	16.8	19.8	33.6	56	60	86	47	74.4	2.8
6	7.2	5.7	15.0	16.9	21.0	18.0	52	84	99	44	38.7	2.8
7	7.6	7.6	14.0	11.0	23.1	19.2	49	126	91	43	26.6	2.8
8	6.4	8.0	13.5	16.2	24.5	19.2	45	130	89	50	23.8	3.6
9	3.9	7.2	14.0	26.6	24.5	37.8	45	141	94	41	21.7	4.2
10	3.6	7.6	15.0	17.4	22.4	52.0	56	141	111	36	19.8	4.2
11	3.6	5.4	15.0	14.5	21.7	54.0	66	131	110	31	19.8	3.9
12	3.9	7.6	12.0	10.0	19.2	58.3	74	116	94	29	19.2	4.2
13	3.9	10.0	15.6	12.0	16.2	61.6	68	111	79	27	19.2	3.9
14	3.9	13.5	14.5	15.6	22.4	58.3	62	94	74	28	16.2	3.9
15	5.1	11.5	15.0	19.2	24.5	51.0	59	89	78	28	11.5	3.6
16	4.8	14.5	10.5	21.0	25.2	51.0	59	77	84	27	7.6	3.3
17	4.2	13.0	8.8	20.4	25.2	57.2	66	78	80	25	7.6	3.0
18	3.9	15.0	9.2	25.9	24.5	57.2	71	77	78	22	9.2	3.0
19	3.9	16.8	9.2	20.4	24.5	60.5	71	79	83	20	7.2	3.6
20	3.9	17.4	9.6	18.0	23.8	62.7	70	84	82	17	6.0	3.6
21	3.6	17.4	11.5	11.5	24.5	90.0	68	82	76	18	5.4	3.6
22	3.6	16.2	13.5	13.5	25.2	75.6	67	83	66	19	4.8	3.6
23	3.6	16.2	16.8	16.2	23.8	70.8	78	84	59	18	4.2	3.3
24	3.6	16.2	14.5	16.2	24.5	56.1	86	84	56	18	3.9	3.6
25	5.4	11.5	12.5	15.6	24.5	45.0	96	84	48	20	3.3	3.6
26	7.2	15.0	15.6	15.0	24.5	48.0	94	82	46	20	2.6	3.6
27	8.4	18.0	10.5	15.0	25.9	51.0	130	68	58	22	2.6	4.5
28	8.8	9.2	12.0	13.5	25.2	54.0	130	76	64	22	2.6	4.2
29	9.2	14.0	13.5	8.0	18.6	57.0	130	77	64	20	2.6	3.3
30	9.2	18.6	11.0	12.5		60.0	113	76	64	20	2.6	3.0
31	8.8		13.0	10.0		63.0		77		19	2.6	

Note.—No gage-height record, discharge estimated, Mar. 26–31, Apr. 2, 5–7.

Monthly discharge of Clear Creek at Sevier, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9.2	3.6	5.64	347
November	18.6	5.1	11.5	684
December	16.8	8.8	13.3	818
January	26.6	8.0	15.7	965
February	25.9	13.5	22.2	1,290
March	90	18	48.6	2,990
April	130	45	73.6	4,380
May	141	56	89.4	5,500
June	111	46	77.7	4,620
July	62	17	30.8	1,890
August	74.4	2.6	15.5	953
September	4.5	2.5	3.45	205
The year	141	2.5	33.9	24,600

COVE CANAL AT SEVIER, UTAH.

Location.—In sec. 32, T. 25 S., R. 4 W., 90 feet below head of canal and about three-quarters of a mile west of post office at Sevier, Sevier County.

Records available.—May 29, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder with outside and inside staff gages.

Discharge measurements.—Made by wading at gage.

Channel and control.—Earth section. Wooden weir just below gage serves as control.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed several times during seasons of 1915 and 1916, the changes being due to removal and replacement of flashboards on control. Several poorly defined rating curves used. Operation of water-stage recorder satisfactory throughout each season. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records fair.

Canal diverts water from left bank of Clear Creek in the NW. ¼ sec. 32, T. 25 S., R. 4 W. Water is used for irrigation between Sevier and Joseph.

Discharge measurements of Cove canal at Sevier, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 25	J. J. Sanford	2.22	20.8	May 26	J. J. Sanford	0.55	6.0
May 26	.....do	2.32	24.7	June 5	.....do	2.53	32.8
June 28	.....do	1.87	29.7	22	.....do	2.20	21.0
July 13	Porter and Sanford	1.60	24.9	July 8	.....do	1.87	23.7
Aug. 9	J. J. Sanford	.96	8.5	18	.....do	1.25	13.0
Sept. 17	.....do	1.00	7.2	21	.....do	1.01	11.7
				21	.....do	1.01	12.5
1916.				21	.....do	.70	7.6
Apr. 29	J. J. Sanford	1.53	19.0	Aug. 15	.....do	.70	6.3
May 1	.....do	2.38	17.7	Sept. 15	.....do	.71	7.9
17	.....do	2.05	20.3				

Daily discharge, in second-feet, of Cove canal at Sevier, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	12	8	12	15	10
2	12	9	17	16	10
3	13	10	10	17	10
4	18	11	10	18	10
5	14	12	10	19	10
6	13	13	10	20	10
7	11	14	10	21	8

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							
1	....	5.7	27	27	32	14	8.1
2	....	6.5	27	24	33	13	6.2
3	....	7.7	26	16	35	12	11
4	....	8.1	25	16	36	12	13
5	....	8.3	25	16	39	13	11
6	....	7.7	22	15	33	13	10
7	....	7.4	20	20	26	12	9.0
8	....	8.4	20	25	29	9.2	8.8
9	....	7.7	17	28	34	8.7	8.4
10	....	6.9	16	32	33	8.4	7.8
11	....	7.2	17	33	31	8.1	7.4
12	....	7.2	25	32	30	8.1	7.4
13	....	9.2	27	30	25	8.2	7.2
14	....	14	28	28	21	7.5	8.2
15	....	19	27	27	21	7.2	8.0
16	....	19	27	27	20	8.4	7.0
17	....	19	27	27	16	8.5	7.0
18	....	21	25	27	10	8.1	....
19	....	21	14	28	12	8.2	....
20	....	22	14	29	13	8.8	....
21	....	24	14	29	13	11	....
22	....	24	14	28	15	10	....
23	....	22	14	29	13	10	....
24	....	22	14	31	15	10	....
25	....	21	19	32	14	10	....
26	1.8	21	21	32	14	8.7	....
27	4.6	22	17	31	18	8.5	....
28	5.4	23	16	30	15	8.0	....
29	5.6	20	21	29	17	7.8	....
30	5.1	20	27	28	17	8.6	....
31	5.2	....	27	....	15	9.0	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	24	28	22	6	7	16	......	21	20	14	8	8
2	......	24	29	22	7	8	17	......	20	19	12	8	8
3	......	22	30	22	8	8	18	......	20	19	12	8	9
4	......	23	30	20	7	8	19	......	21	19	16	5	8
5	......	26	28	20	9	8	20	......	22	18	15	6	9
6	......	27	23	17	8	8	21	......	21	18	9	7	9
7	......	22	24	17	7	8	22	......	17	18	6	7	9
8	......	26	23	10	7	9	23	......	18	19	6	7	9
9	......	26	24	21	6	10	24	17	19	18	7	7	10
10	......	28	24	18	6	10	25	......	17	20	9	8	8
11	......	25	24	16	6	8	26	......	11	22	9	8	8
12	......	24	24	14	6	8	27	......	20	25	10	8	10
13	......	22	22	13	6	8	28	......	14	26	10	8	10
14	......	20	20	15	6	8	29	......	15	24	8	7	8
15	......	20	20	16	7	8	30	18	20	24	7	6	8
							31	......	27	......	6	8	......

NOTE.—1915: No flow Mar. 20-25. Discharge estimated Sept. 18-30, 7 second-feet. 1916: Discharge estimated Apr. 12-23, 2 second-feet; Apr. 25-29, 17.5 second-feet.

Monthly discharge of Cove canal at Sevier, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
1914.			1915.		
October 1-21	11.4	475	September	7.9	469
1915.			1916.		
March 20-31	2.3	55	April 12-30	7.7	291
April	15.1	898	May	21.3	1,310
May	21.3	1,310	June	22.8	1,360
June	26.9	1,600	July	13.5	830
July	22.4	1,380	August	6.9	425
August	9.6	591	September	8.6	513

MONROE-SOUTH BEND CANAL NEAR JOSEPH, UTAH.

Location.—In sec. 27, T. 25 S., R. 4 W., 200 feet below head of canal, 2 miles south of Joseph, Sevier County.

Records available.—April 18, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on left bank, with inside and outside staff gages.

Discharge measurements.—Made from highway bridge half a mile below gage.

Channel and control.—Earth section. Bed of stream composed of sandy loam. Wooden weir 40 feet below gage serves as permanent control.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed April 1, 1915; permanent during season of 1916. Rating curves well defined before and after change in 1915; one well-defined curve used in 1916. Operation of water-stage recorder satisfactory throughout each irrigation season. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Canal diverts water from right bank of Sevier River in the NW. ¼ sec. 27, T. 25 S. R. 4 W. Water is used for irrigation southeast of Joseph.

Discharge measurements of Monroe-South Bend canal near Joseph, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 20	1.02	31.6	Aug. 5	1.64	81	May 16	1.74	97
Apr. 24	1.72	91	21	1.51	70	29	1.90	105
24	1.72	88	Sept. 17	1.35	58	June 23	1.72	89
May 14	1.70	86	Oct. 12	.92	28	July 6	1.68	80
25	1.64	82				6	1.68	80
June 9	1.78	92	1916.			21	1.67	83
28	1.78	93	Mar. 9	1.11	41.4	Aug. 15	1.68	84
July 6	1.80	88	Apr. 25	[a] 2.04	91	Sept. 16	1.64	81
7	1.80	93	May 6	1.60	81	16	1.30	53

[a] Waste gates open.

Daily discharge, in second-feet, of Monroe-South Bend canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	49	11	42	21	35
2	52	12	35	22	35
3	50	13	35	23	35
4	49	14	35	24	22
5	48	15	35		
6	47	16	35		
7	45	17	35		
8	44	18	35		
9	43	19	35		
10	42	20	35		

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	......	26	84	88	91	79	50	......
2	......	38	84	89	91	80	48	......
3	......	42	84	89	91	81	47	......
4	......	56	83	89	91	81	46	......
5	......	66	84	90	92	81	46	......
6	......	73	84	90	94	81	45	......
7	......	80	83	91	95	80	43	......
8	11	84	84	91	95	80	43	......
9	11	84	86	92	94	80	45	......
10	11	87	86	93	94	80	48	......
11	11	90	86	94	65	80	48	......
12	31	92	86	92	48	80	48	28
13	31	92	86	92	70	79	47	......
14	31	83	86	92	83	79	47	......
15	31	82	84	91	82	78	50	......
16	31	81	84	92	82	78	54	......
17	31	80	85	94	81	77	57	......
18	31	85	85	94	80	76	55	......
19	31	89	87	94	80	76	54	......
20	31	88	88	94	80	76	56	......
21	31	88	88	94	80	64	54	......
22	31	87	87	94	80	57	53	......
23	31	85	84	94	79	56	51	......
24	31	87	83	94	79	56	47	......
25	31	88	81	94	79	56	43	......
26	31	88	81	94	79	56	46	......
27	29	88	81	93	79	56	50	......
28	21	88	82	92	79	54	50	......
29	20	88	86	91	79	53	50	......
30	20	85	87	91	79	52	56	......
31	20	......	88	......	79	50	......	......

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	88	102	88	84	80	16	63	92	90	82	86	82
2	......	85	99	86	84	79	17	61	93	90	83	86	81
3	......	82	100	85	84	78	18	75	96	89	83	87	80
4	......	82	87	85	83	77	19	85	100	90	83	87	78
5	......	82	81	85	84	77	20	85	104	90	83	86	80
6	......	82	85	85	85	79	21	85	103	90	83	85	80
7	......	81	86	86	85	79	22	89	102	90	82	85	79
8	......	81	87	86	85	82	23	92	102	89	82	84	78
9	......	78	89	85	85	82	24	98	100	89	82	83	77
10	......	76	92	85	85	82	25	93	100	89	81	82	76
11	......	76	92	84	85	82	26	87	92	88	73	82	75
12	......	75	89	83	84	82	27	87	96	89	50	82	75
13	......	82	72	82	78	81	28	87	105	89	59	81	74
14	......	93	37	82	88	82	29	87	105	89	83	81	74
15	52	93	40	82	86	81	30	87	105	89	84	80	73
							31	......	102	......	84	80	......

NOTE.—No flow April 1-14, 1916.

Monthly discharge of Morrow-South Bend canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-24	30.7	1,460	September	49.2	2,930
1915.			1916.		
March 8-31	25.8	1,230	April	43.8	2,610
April	79.0	4,700	May	91.4	5,620
May	84.7	5,210	June	85.9	5,110
June	92.1	5,480	July	81.5	5,010
July	82.2	5,050	August	83.9	5,160
August	70.7	4,350	September	78.8	4,690

SEVIER VALLEY CANAL NEAR JOSEPH, UTAH.

Location.—About on line between secs. 22 and 27, T. 25 S., R. 4 W., at station 20 on canal, 1½ miles south of Joseph, Sevier County.

Records available.—May 18, 1912, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on left bank, May 13, 1913, to September 30, 1916; original gage, used May 18, 1912, to May 12, 1913, was a vertical staff 10 feet above State weir, in the SE. ¼ sec. 15, T. 25 S., R. 4 W.

Discharge measurements.—Made from bridge 600 feet downstream or by wading.

Channel and control.—Earth section. Concrete weir 20 feet below gage serves as control.

Diversions.—Joseph canal diverts from right bank of Sevier Valley canal just above gage.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed several times in 1915 by placing flashboards on control and by accumulation of silt back of control crest. During 1916 these troubles were eliminated except for a few days in March, when there was very little water in the canal and flashboards were inserted to force water into Joseph canal. Several rating curves for 1915; one well-defined curve for 1916. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records good.

Canal diverts water from left bank of Sevier River about 1½ miles south of Joseph, in the NW. ¼ sec. 27, T. 25 S., R. 4 W. Water is used for irrigation in Sevier Valley as far north as Redmond.

Discharge measurements of Sevier Valley canal near Joseph, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 5	0.52	27.8	Aug. 31	2.24	126	Apr. 25	3.65	253
Apr. 25	3.65	225	Sept. 1	3.27	219	25	3.11	262
May 14	4.09	264	17	3.27	225	May 6	3.82	279
25	4.04	258	Oct. 12	2.30	135	16	3.82	274
June 8	4.07	260	Nov. 1	2.55	43.3	29	3.96	292
12	4.12	266				June 10	4.06	290
28	4.14	266	1916.			10	4.06	294
July 6	4.30	278	Mar. 8	2.28	39.6	22	4.05	300
23	4.29	280	11	2.66	21.5	July 6	4.06	297
Aug. 5	4.17	266	Apr. 7	2.18	135	Aug. 5	3.96	297
21	3.74	226	7	2.18	133	Sept. 15	3.91	279
28	3.74	223	19	3.54	244			

Daily discharge, in second-feet, of Sevier Valley canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	October.	Day.	October.	Day.	October.
1914.		1914.		1911.	
1	172	9	170	17	158
2	171	10	169	18	158
3	173	11	169	19	141
4	173	12	167	20	129
5	172	13	165	21	129
6	170	14	162	22	129
7	170	15	159	23	106
8	170	16	159	24	85

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1915.									
1	....	0	244	261	264	274	218	223	43
2	....	16	243	258	260	272	222	219	....
3	....	0	238	257	264	270	236	219	....
4	....	11	248	257	268	272	222	153	....
5	28	22	253	256	273	273	220	162	....
6	28	26	255	257	280	272	220	163	....
7	28	27	254	262	281	273	220	161	....
8	30	28	252	261	279	270	220	159	....
9	31	35	244	266	276	270	221	149	....
10	30	46	253	264	276	268	221	133	....
11	24	46	255	264	273	266	222	136	....
12	34	54	253	266	275	267	221	134	....
13	34	106	257	259	280	269	224	135	....
14	34	121	261	259	279	272	228	134	....
15	34	121	263	262	279	274	231	139	....
16	34	121	258	263	277	276	229	139	....
17	34	124	261	261	277	276	225	109	....
18	33	150	265	263	273	276	221	60	....
19	33	182	257	269	270	274	223	55	....
20	33	198	249	269	268	273	222	50	....
21	35	208	259	266	270	234	224	46	....
22	39	217	258	265	277	216	226	43	....
23	51	221	248	265	277	218	227	43	....
24	51	224	251	264	276	224	230	43	....
25	52	221	259	264	275	228	233	44	....
26	27	220	263	266	276	227	229	44	....
27	0	224	259	269	275	227	225	43	....
28	0	244	253	269	276	228	225	43	....
29	0	253	258	267	278	227	225	43	....
30	0	252	258	266	277	227	225	43	....
31	0	....	263	....	276	215	....	43	....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							
1	....	96	249	294	291	288	282
2	....	73	254	272	296	290	280
3	....	78	270	257	294	289	279
4	....	86	272	250	295	284	274
5	....	82	265	271	296	288	271
6	....	115	272	294	296	292	270
7	....	123	280	292	298	292	275
8	....	133	274	291	293	293	279
9	....	135	283	290	283	293	278
10	....	136	287	294	283	290	279
11	....	145	287	288	288	288	277
12	....	176	283	287	286	286	278
13	....	209	283	295	284	286	282
14	....	209	282	290	286	292	282
15	....	216	276	294	284	299	281
16	....	212	276	301	286	292	288
17	....	211	290	294	286	290	286
18	....	212	300	289	283	286	284
19	....	225	283	292	287	286	280
20	....	239	287	293	288	289	281
21	....	238	290	299	283	296	275
22	....	244	291	295	278	295	272
23	....	240	291	293	278	288	271
24	....	248	290	292	278	284	268
25	....	250	290	292	280	284	265
26	60	259	273	291	281	281	264
27	78	253	271	293	281	277	263
28	98	259	277	294	279	276	262
29	90	263	291	292	282	276	262
30	94	258	284	292	284	278	260
31	96	....	290	....	287	282	....

Monthly discharge of Sevier Valley canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-24	155	7,380	October	107	6,580
1915.			1916.		
March 5-31	28	1,500	March 26-31	86	1,020
April	124	7,380	April	187	11,100
May	255	15,700	May	280	17,200
June	263	15,700	June	289	17,200
July	274	16,800	July	286	17,600
August	255	15,700	August	287	17,600
September	225	13,400	September	275	16,400

SEVIER VALLEY CANAL NEAR RICHFIELD, UTAH.

Location.—In SW. ¼ sec. 8, T. 23 S., R. 2 W., at State weir or head of State extension canal, 100 feet below bridge on county road from Richfield to Aurora, about 3½ miles northeast of Richfield, Sevier County.

Records available.—May 21, 1912, to September 30, 1916; irrigation seasons only.

Gage.—Friez water-stage recorder on left bank at the weir, about station 815 on the canal.

Discharge measurements.—Made by wading or from bridge about 200 feet below gage.

Channel and control.—Channel is gravel and sandy loam. Wooden weir just below gage forms permanent control.

Diversions.—A great number of laterals divert water above the station; water passing the station is available for the State Piute project.

Regulation.—Flow controlled by headgates and numerous diversions above.

Accuracy.—Stage-discharge relation permanent during each irrigation season. Rating curves well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Discharge measurements of Sevier Valley canal near Richfield, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Apr. 22	1.63	79	Aug. 30	2.55	165	Apr. 28	2.30	141
22	1.66	84	Oct. 26	1.04	42.2	May 13	2.42	147
May 7	2.43	148				25	2.69	176
25	2.58	166	1916.			June 9	2.68	178
June 11	2.43	149	Mar. 10	.65	11.3	21	2.60	166
July 9	2.50	154	Apr. 6	1.22	52	July 17	2.83	190
12	2.50	154	6	1.41	62	Aug. 12	2.78	184
12	2.50	153	10	1.88	106	Sept. 7	2.43	149
Aug. 4	2.57	165	17	2.00	116			

Daily discharge, in second-feet, of Sevier Valley canal near Richfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1915.							1916.						
1	......	122	165	158	163	157	1	11	135	169	154	168	153
2	......	128	160	153	158	161	2	11	122	174	168	160	149
3	......	120	169	145	164	172	3	40	142	142	162	172	148
4	......	124	173	156	167	167	4	49	153	137	163	210	134
5	......	134	165	158	160	158	5	59	132	132	160	160	151
6	......	136	163	163	157	160	6	69	131	177	172	138	156
7	......	144	172	161	165	160	7	88	146	179	174	170	158
8	......	154	168	160	159	169	8	102	148	173	176	191	177
9	......	147	156	160	160	170	9	100	150	175	159	197	179
10	......	155	156	158	158	163	10	92	153	176	161	193	178
11	......	156	152	141	152	175	11	88	152	165	172	192	164
12	5	151	165	151	162	167	12	104	143	164	162	185	164
13	8	154	156	160	170	169	13	133	136	172	144	189	156
14	10	160	151	167	164	178	14	128	150	168	160	192	168
15	10	160	148	162	161	178	15	114	147	170	166	198	176
16	10	153	160	154	173	172	16	108	149	172	176	189	176
17	10	154	160	157	177	171	17	113	160	168	181	181	180
18	30	154	157	158	173	165	18	104	166	172	166	172	180
19	60	154	160	157	169	157	19	104	167	178	160	161	170
20	70	160	170	154	163	162	20	141	164	175	156	156	171
21	75	168	154	164	138	174	21	130	178	159	159	165	183
22	80	175	153	161	115	170	22	122	180	172	170	163	183
23	84	169	152	169	120	171	23	121	173	167	174	154	180
24	94	165	155	170	135	172	24	133	170	166	162	150	183
25	96	163	153	173	151	173	25	130	175	162	174	152	172
26	103	179	159	170	160	170	26	128	177	159	151	156	182
27	109	156	160	176	153	174	27	126	169	174	172	148	199
28	123	167	160	170	156	165	28	129	171	169	180	144	202
29	134	166	158	169	158	164	29	132	183	167	168	151	200
30	127	165	164	175	158	167	30	130	174	159	174	145	202
31	......	169	......	172	153	......	31	......	170	......	172	152	......

NOTE.—1915: Discharge estimated by comparion with records at station near Joseph, Apr. 1-11, 2 second-feet; Apr. 12-21, as given in daily discharge table. Record discontinued Sept. 30 and an approximate idea of the flow Oct. 1-25 can be obtained by comparison with Joseph record.

Monthly discharge of Sevier Valley canal near Richfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
April	134	2	42.0	2,500
May	179	120	154	9,470
June	173	148	160	9,520
July	176	141	161	9,900
August	177	115	157	9,650
September	178	157	168	10,000
1916.				
April	133	11	101	6,010
May	183	122	157	9,650
June	179	132	167	9,940
July	181	144	166	10,200
August	210	138	170	10,400
September	202	134	172	10,200

STATE CANAL NEAR REDMOND, UTAH.

Location.—In W. ½ sec. 14, T. 20 S., R. 1 W., at station 1,304 of canal survey, about 5 miles north of Redmond, Sevier County.

Records available.—May 10, 1913, to September 30, 1916; irrigation seasons only.

Gage.—Stevens continuous water-stage recorder on right bank August 6, 1915, to September 30, 1916; May 10, 1913, to August 5, 1915, vertical staff on right bank.

Discharge measurements.—Made from bridge 10 feet upstream from gage or by wading.

Channel and control.—Bed composed of gravel and hardpan; fairly permanent.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 4.05 feet at 7 a. m. September 9 (discharge, 142 second-feet).

1913–1916: Maximum stage occurred in 1916.

Diversions.—Numerous diversions above gage.

Regulation.—Flow controlled by headgates and by diversions above.

Accuracy.—Stage-discharge relation not entirely permanent; assumed permanent during 1915; changed during period May 20–26, 1916. Rating curves fairly well defined. Staff gage read twice daily to hundredths prior to August 6, 1915; operation of water-stage recorder satisfactory after that date. Mean daily gage height obtained by averaging staff-gage readings for day or by inspecting gage-height graph. Daily discharge ascertained by applying mean daily gage height to rating table except for days of considerable fluctuation in stage, for which it was determined by averaging discharge obtained by applying hourly gage height to rating table. Records good.

State canal is an extension of the Sevier Valley canal. See Sevier Valley canal near Joseph for point of diversion from Sevier River.

Discharge measurements of State canal near Redmond, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
July 10	2.93	87	Apr. 28	0.90	6.8
19	3.33	108	May 15	2.20	52
Aug. 6	3.24	101	27	2.92	81
Sept. 4	3.20	102	June 20	1.76	28.4
29	1.05	8.1	July 7	2.70	72
			26	2.90	78

Daily discharge, in second-feet, of State canal near Redmond, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1915.						1915.					
1	......	71	......	......	......	16	......	......	96	......	91
2	......	72	......	......	81	17	56	......	96	......	63
3	......	81	......	......	100	18	64	......	101	......	41
4	......	88	......	......	107	19	62	......	106	38	......
5	......	91	......	......	102	20	65	66	......	84	......
6	......	107	......	99	43	21	66	75	......	78	......
7	......	107	......	97	......	22	......	74	......	54	......
8	......	......	......	98	......	23	......	74	......	48	......
9	......	......	......	92	......	24	......	91	......	64	......
10	......	......	88	104	......	25	......	84	......	83	......
11	......	......	85	96	......	26	......	84	......	61	7
12	......	......	91	85	29	27	......	84	......	......	44
13	......	......	85	30	119	28	......	......	......	......	55
14	......	......	94	......	104	29	......	......	......	......	8
15	......	......	98	......	102	30	......	......	......	......	4
						31	......	......	......	......	......

Daily discharge, in second-feet, of State canal near Redmond, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1		21	68				16		51				
2		42	5.5				17		60		42		
3		48					18		63				
4		62					19		32				
5		58				20	20			36			
6		35		9.5	82	121	21			55			84
7				74	78	133	22			63	66	81	124
8				72	92	132	23			64	79	70	122
9				72	6	76	24			66	80	74	83
10			42	72	16	30	25			64	80	68	32
11				76	78	22	26			64	81	82	24
12				66	80	6	27		33	64	82	66	27
13					53		28	3.5	5		58		8.5
14		21					29	9.5	35				.5
15		54					30	6.5	70				1.0
							31		72				

NOTE.—No flow for periods of missing discharge.

Monthly discharge of State canal near Redmond, Utah, for the years ending Sept. 30, 1915 and 1916.

Month	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
May 17-31	66	0	20.9	621
June	107	0	41.6	2,480
July	106	0	30.3	1,860
August	104	0	39.1	2,400
September	119	0	36.7	2,180
1916.				
April 28-30	9.5	3.5	6.50	38
May	72	0	24.7	1,520
June	68	0	19.7	1,170
July	82	0	32.6	2,000
August	92	0	29.9	1,840
September	133	0	34.9	2,080

JOSEPH CANAL NEAR JOSEPH, UTAH.

LOCATION.—In SE. ¼ sec. 22, T. 25 S., R. 4 W., 100 yards below head of canal, about 1¼ miles south of Joseph, Sevier County, on road to Marysvale.

RECORDS AVAILABLE.—April 6, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder, with outside and inside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel section. Concrete weir 20 feet below gage serves as permanent control.

DIVERSIONS.—Above all diversions.

REGULATION.—Flow controlled by diversion weir and head gates of Sevier Valley canal.

ACCURACY.—Stage-discharge relation changing during 1915; permanent during 1916. Shifting in 1915 probably caused by sediment washing in and out above crest of control. Backwater during periods indicated in footnote to table of daily discharge caused by a check below control used to force water into a small lateral. Two rating curves used for 1915; one well defined curve for 1916. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records for 1915 good; for 1916, excellent.

Canal diverts water from right bank of Sevier Valley canal in the SE. ¼ sec. 22, T. 25 S., R. 4 W. Water used for irrigation in and near Joseph.

Discharge measurements of Joseph canal near Joseph, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 5	0.26	1.4	Sept. 17	0.94	17.4	May 16	1.68	47.2
Apr. 24	1.48	31.7				16	1.68	47.7
25	1.46	35.2	1916.			16	1.52	38.4
May 14	1.76	46.8	Mar. 8	.70	10.1	29	1.68	47.1
June 9	1.52	37.6	11	.65	8.7	June 10	2.13	66
28	1.50	39.3	Apr. 25	1.83	53	July 6	1.42	37.9
28	1.50	38.4	25	1.47	38.3	Aug. 15	.44	5
July 6	1.50	39.8	25	.55	7.1	Sept. 15	1.18	26.7
6	1.50	38.4	25	.90	18.2	19	.80	13.9
23	1.44	35.7	25	.96	21.3	19	1.08	23.1
Aug. 21	1.18	22.3	25	1.30	32			

Daily discharge, in second-feet, of Joseph canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	12	9	12	17	12
2	12	10	12	18	12
3	12	11	12	19	12
4	12	12	12	20	12
5	12	13	12	21	12
6	12	14	12	22	12
7	12	15	12	23	12
8	12	16	12	24	12

Day	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915								
1		0	37	39	36	32	18	18
2		0	36	40	34	32	20	18
3		0	35	40	37	31	22	17
4		0	36	39	41	31	21	21
5	1.4	0	37	39	41	31	21	31
6	1.6	0	40	38	39	32	21	31
7	1.8	0	40	36	39	32	21	33
8	2.0	0	39	36	38	33	21	33
9	2.2	2.1	37	41	37	32	21	30
10	2.8	6.3	30	48	36	31	21	21
11	2.9	6.5	21	45	35	31	20	22
12	2.4	13	19	45	36	33	17	20
13	3.4	20	42	42	37	33	17	
14	3.4	20	47	39	38	33	18	
15	3.5	20	45	39	38	32	18	
16	3.5	22	40	39	38	33	19	
17	3.2	22	42	40	39	34	18	
18	2.4	28	41	42	35	33	18	
19	2.9	32	41	40	33	32	18	
20	3.5	32	41	40	34	32	18	
21	3.5	33	40	39	35	29	18	
22	4.9	33	39	39	37	25	18	
23	8.0	32	36	39	37	22	18	
24	8.2	32	37	39	36	19	18	
25	8.0	35	39	39	36	19	18	
26	6.9	35	42	39	37	18	18	
27	6.9	35	40	38	38	18	18	
28	8.0	36	37	38	37	19	18	
29	5.4	36	38	37	36	19	18	
30	0	37	37	37	33	19	18	
31	0		38		33	17		

Daily discharge, in second-feet, of Joseph canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	3	48	46	47	35	33	16	50	44	45	34	23	34
2	4	51	39	42	39	30	17	47	40	40	33	38	32
3	4	25	34	39	39	29	18	42	41	42	32	37	31
4	5	29	32	38	40	28	19	38	40	50	33	37	30
5	6	49	38	38	40	27	20	34	40	50	34	34	33
6	4	50	43	38	43	28	21	32	42	52	32	8	29
7	0	54	45	38	43	28	22	38	42	54	30	12	28
8	0	52	43	40	43	27	23	41	40	54	30	34	32
9	0	52	52	43	45	25	24	42	39	51	30	47	35
10	0	53	62	37	45	27	25	48	40	44	31	46	33
11	0	54	62	34	46	26	26	52	33	42	31	38	31
12	2	54	54	34	47	28	27	51	36	43	31	32	29
13	12	54	42	33	48	28	28	50	37	44	31	34	28
14	27	50	44	34	21	28	29	50	45	46	33	33	28
15	44	48	46	34	5	28	30	48	43	46	33	36	26
							31	......	44	......	33	36	......

NOTE.—Daily discharge estimated, because of backwater from below control Apr. 22–24, 29–30, May 18–19; June 1–2, July 11–13, 19–21, Aug. 4–6, 13–14, 20–22, 28–29, Sept. 5–7, 13–14, 1915.

Monthly discharge of Joseph canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914			1915.		
October 1-24	12.0	571	October 1-12	24.6	585
1915.			1916.		
March 5-31	3.8	203	April	25.8	1,540
April	19.0	1,130	May	44.1	2,710
May	37.7	2,320	June	46.4	2,760
June	39.7	2,360	July	34.8	2,140
July	36.6	2,250	August	35.6	2,190
August	28.0	1,720	September	29.3	1,740
September	18.9	1,120			

WELLS CANAL NEAR JOSEPH, UTAH.

LOCATION.—In the SW. ¼ sec. 23, T. 25 S., R. 4 W., three-quarters of mile below head of canal and 2 miles by wagon road south of Joseph, Sevier County.

RECORDS AVAILABLE.—April 7, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made from bridge across flume 20 feet above gage.

CHANNEL AND CONTROL.—Wooden flume about 4½ feet wide. Permanent control is afforded by plank across flume 10 feet below gage.

DIVERSIONS.—None above station.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation permanent. Rating curves well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Canal diverts water from right bank of Sevier River in the NE. ¼ sec. 27, T. 25 S., R. 4 W. Water is used for irrigation near Joseph.

Discharge measurements of Wells canal near Joseph, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 14	J. J. Sanford	1.64	18.9	Mar. 9	J. J. Sanford	0.78	3.8
June 9	do	1.61	19.5	Apr. 25	do	1.53	18.7
12	do	1.62	19.7	May 16	do	2.11	35.8
28	do	1.70	21.3	29	do	1.84	24.5
July 7	do	1.79	22.7	June 5	do	1.65	20.0
13	Porter and Sanford	1.70	21.8	5	do	1.45	15.2
Aug. 5	J. J. Sanford	1.35	14.3	23	do	1.60	19.0
21	do	1.20	10.5	July 6	do	1.34	13.5
				Aug. 15	do	1.44	16.6
				Sept. 16	do	1.35	10.4

Daily discharge, in second-feet, of Wells canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	6	11	7	21	8
2	6	12	7	22	8
3	7	13	7	23	8
4	7	14	7	24	8
5	6	15	7		
6	7	16	7		
7	7	17	7		
8	7	18	8		
9	7	19	8		
10	7	20	8		

Day.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
1915.								
1		0.5	19	19	22	15	7.4	6.9
2		.5	19	21	21	14	7.4	6.5
3		4.9	19	20	21	14	7.7	6.4
4		.7	19	20	21	14	7.7	4.1
5		7.6	20	19	23	14	7.5	4.5
6		9.1	20	19	23	15	7.5	4.5
7		8.6	19	18	23	15	7.5	4.3
8		8.7	19	18	22	15	7.7	4.3
9		8.2	19	19	22	15	7.7	4.5
10		7.4	18	20	22	15	7.5	6.7
11		7.9	18	20	27	15	7.7	8.0
12		6.5	18	20	31	14	8.2	8.4
13		9.2	18	19	25	14	7.7	
14		15	19	19	21	14	7.4	
15		21	19	17	21	14	9.1	
16		21	19	17	21	14	8.7	
17		21	19	17	20	14	8.2	
18		19	20	20	17	14	8.2	
19		20	21	21	14	14	8.0	
20	0.2	22	20	21	14	14	7.7	
21	.5	22	20	21	14	10	7.5	
22	.8	22	20	20	14	6.4	7.4	
23	1.2	22	19	21	15	6.2	7.2	
24	1.6	23	18	21	15	6.4	6.9	
25	1.6	23	19	21	15	6.4	6.9	
26	1.6	23	19	21	15	6.5	6.9	
27	1.6	21	18	21	15	7.2	6.9	
28	1.6	19	12	22	15	7.0	6.9	
29	1.3	19	17	22	15	7.0	6.9	
30	2.0	19	17	22	15	7.0	6.9	
31	1.2		18		15	7.5		

Daily discharge, in second-feet, of Wells canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	2.5	5.5	27.5	15.5	14.5	16.0	16	16.5	34.5	17.5	11.5	16.0	14.0
2	2.5	15.0	23.5	14.5	15.0	15.5	17	16.5	34.0	18.5	16.5	16.0	13.5
3	1.5	23.0	17.5	14.0	15.0	15.5	18	16.5	33.5	17.5	17.5	16.5	13.5
4	1.0	25.0	14.0	14.0	15.0	13.5	19	16.5	32.5	19.0	14.0	15.5	13.5
5	1.0	30.0	18.5	14.5	15.0	12.0	20	16.0	31.5	19.0	14.0	14.5	14.0
6	1.5	30.0	19.0	14.0	15.5	12.0	21	16.0	30.0	21.0	14.0	15.0	14.0
7	2.0	30.5	19.0	13.0	15.5	12.0	22	16.5	29.5	20.0	14.0	16.0	13.5
8	2.0	31.5	18.0	14.0	15.5	12.5	23	16.5	30.5	19.0	14.0	14.0	13.5
9	2.5	33.0	18.5	13.0	15.5	12.5	24	16.5	30.5	19.0	14.0	13.5	13.0
10	2.0	34.0	20.0	12.5	15.5	12.5	25	19.0	30.5	17.5	14.0	13.5	13.0
11	1.0	34.0	19.0	12.0	15.5	12.5	26	22.0	27.0	16.5	15.0	13.5	13.0
12	6.0	34.0	16.5	11.5	16.5	12.5	27	21.0	25.0	18.0	17.0	13.5	12.5
13	16.5	33.0	20.5	12.0	17.0	13.0	28	21.0	21.5	18.0	16.0	14.0	12.5
14	17.0	32.0	29.0	12.0	15.5	12.5	29	20.5	24.5	17.5	14.5	16.0	12.5
15	17.5	34.5	23.5	12.0	16.0	12.5	30	14.0	26.0	16.5	14.5	17.5	12.0
							31	......	27.0	......	14.5	17.5	......

Monthly discharge of Wells canal near Joseph, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-24	7.2	341	October 1-12	5.8	137
1915.			1916.		
March 20-31	1.3	30	April	11.4	678
April	14.4	857	May	28.9	1,780
May	18.7	1,150	June	19.3	1,150
June	19.9	1,180	July	14.0	860
July	19.2	1,180	August	15.3	940
August	11.8	726	September	13.2	786
September	7.6	450			

MONROE CANAL NEAR ELSINORE, UTAH.

Location.—In SW. ¼ sec. 6, T. 25 S., R. 3 W., 1 mile below head of canal and 3½ miles southwest of Elsinore, Sevier County.

Records available.—April 4, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on left bank, with inside and outside staff gages.

Discharge measurements.—Made by wading.

Channel and control.—One channel at all stages. Bed composed of gravel. Concrete weir with 18-inch flashboards, 15 feet below gage, serves as control.

Diversions.—Not known.

Regulation.—Flow controlled by head gates and flashboards on weir.

Accuracy.—Stage-discharge relation changed slightly at times during 1915 by accumulation of silt behind crest of control; permanent during season of 1916. Rating curves well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph; shifting-control method used for short periods in 1915. Records excellent.

Canal diverts water from right bank of Sevier River in the NW. ¼ sec. 12, T. 25 S., R. 4 W. Water used for irrigation in and near Monroe.

Discharge measurements of Monroe canal near Elsinore, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Mar. 9	J. J. Sanford	0.36	6.4	Mar. 11	J. J. Sanford	0.55	11.1
Apr. 24	do	1.37	57	Apr. 24	do	1.57	74
May 8	do	1.42	59	24	do	1.11	43.7
June 10	Sanford and Jones	1.40	57	24	do	.67	16.1
12	do	1.48	66	24	do	.87	29.3
25	J. J. Sanford	1.50	71	24	do	1.31	57
July 7	Sanford and Jones	1.56	74	May 29	do	1.62	80
22	J. J. Sanford	1.42	63	June 21	do	1.50	72
Aug. 21	Sanford and Jones	1.07	39.3	July 3	do	1.42	64
Sept. 18	J. J. Sanford	1.10	40.7	Aug. 5	do	1.58	76
Oct. 12	do	.88	27.0	Sept. 16	do	1.56	76

Daily discharge, in second-feet, of Monroe canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	48	11	26	21	25
2	48	12	25	22	25
3	48	13	25	23	24
4	48	14	25		
5	48	15	25		
6	48	16	25		
7	41	17	25		
8	26	18	25		
9	26	19	25		
10	26	20	25		

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	54	58	58	70	66	42	41
2	....	54	57	58	70	65	42	40
3	....	55	56	58	71	65	42	40
4	....	57	58	57	72	64	44	37
5	....	61	58	55	73	64	43	36
6	....	61	57	57	74	64	43	36
7	....	58	56	55	74	63	43	36
8	....	55	58	50	74	63	42	36
9	6.3	55	57	55	73	64	42	30
10	6.6	54	58	57	73	62	42	25
11	6.6	53	58	61	73	61	42	26
12	6.6	54	58	69	73	62	43	28
13	6.6	55	57	68	72	62	43	....
14	6.6	58	55	68	64	62	44	....
15	6.6	57	55	67	65	62	43	....
16	4.0	54	56	67	64	64	42	....
17	6.7	56	56	68	64	64	42	....
18	16	59	56	67	64	63	42	....
19	18	58	61	68	64	60	42	....
20	18	60	65	70	64	60	41	....
21	20	62	67	70	64	52	41	....
22	20	60	65	71	64	40	41	....
23	18	61	65	71	64	40	40	....
24	18	63	64	70	65	41	40	....
25	18	63	65	70	65	41	40	....
26	18	62	64	70	66	40	40	....
27	18	59	62	71	66	40	40	....
28	18	55	59	71	65	40	40	....
29	18	56	59	71	65	42	40	....
30	18	57	56	70	66	41	41	....
31	34	....	56	....	66	42	....	....

Daily discharge, in second-feet, of Monroe canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	0	83	81	68	76	67	16	68	92	73	66	78	74
2	0	84	67	64	76	51	17	66	90	67	64	76	74
3	0	75	76	64	76	78	18	38	31	66	62	76	74
4	0	88	68	66	76	78	19	40	50	68	62	76	73
5	0	96	61	66	78	78	20	79	90	70	64	78	75
6	0	96	72	66	79	78	21	77	84	70	66	78	75
7	0	98	72	64	78	68	22	78	84	71	68	78	75
8	3	58	71	67	78	61	23	76	89	71	72	72	74
9	5	82	74	68	78	62	24	74	92	71	72	68	72
10	6	92	76	68	76	61	25	85	90	70	73	68	71
11	7	91	72	66	76	67	26	86	82	70	71	68	70
12	7	90	68	66	78	74	27	88	80	70	76	68	68
13	32	91	73	66	78	74	28	88	82	70	75	68	66
14	56	92	88	66	78	73	29	86	80	68	72	68	64
15	62	92	80	66	78	72	30	85	78	68	72	68	62
							31	......	80	......	76	68	......

NOTE.—Gage height Mar. 24 to Apr. 1 unreliable; crest board on control tampered with; discharge estimated.

Monthly discharge of Monroe canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-23	31.8	1,450	September	41.7	2,480
			October 1-12	34.2	814
1915.			1916.		
March 9-31	14.2	647	April	43.1	2,560
April	57.5	3,420	May	83.1	5,110
May	59.1	3,630	June	71.4	4,250
June	64.8	3,840	July	68.0	4,180
July	68.0	4,180	August	74.7	4,590
August	55.5	3,410	September	70.3	4,180

ELSINORE CANAL NEAR ELSINORE, UTAH.

LOCATION.—In NW. ¼ sec. 6, T. 25 S., R. 3 W., about 300 yards below head of canal and 2½ miles southwest of Elsinore, Sevier County.

RECORDS AVAILABLE.—April 11, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder, with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Concrete weir 10 feet below gage serves as control.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation changed slightly during 1915 by sand accumulating above control; permanent during 1916. Rating curves well defined. Operation of water-stage recorder satisfactory throughout each season. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph; shifting-control method used for short periods in 1916. Records for 1915 good; for 1916 excellent.

Canal diverts water from left bank of Sevier River just above the Denver & Rio Grande Railroad bridge over the river south of Elsinore, in the NW. ¼ sec. 6, T. 25 S., R. 3 W. Water used for irrigation in and near Elsinore.

Discharge measurements of Elsinore canal near Elsinore, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 8	0.58	0.9	Aug. 21	1.23	15.3	Apr. 25	1.50	25.3
Apr. 23	1.72	32.8	Sept. 18	1.26	15.0	May 29	1.36	21.2
May 8	1.53	25.0				July 3	1.60	28.4
June 10	1.78	34.0	1916.			Aug. 5	1.60	28.2
25	1.74	32.6	Mar. 7	.48	0.3	Sept. 15	1.45	20.5
July 7	1.74	33.4	Apr. 26	.95	7.1			
22	1.70	34.4	26	2.02	45.7			

Daily discharge, in second-feet, of Elsinore canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1		0.6	32	33	33	37	15	19
2		.6	28	29	32	38	15	15
3		.8	26	27	33	38	15	16
4		6.3	26	28	34	35	15	11
5		14	26	25	35	33	15	9.1
6		16	26	24	31	33	15	8.8
7		19	25	24	33	32	15	8.5
8	1.0	23	25	23	32	31	15	8.0
9	1.1	23	24	26	32	31	15	7.8
10	1.2	27	26	32	31	31	15	13
11	1.2	31	29	32	30	32	15	14
12	1.4	29	31	32	30	31	15	
13	1.4	29	33	31	31	31	15	
14	1.5	29	34	31	31	31	15	
15	1.4	28	36	30	31	31	15	
16	1.4	28	37	34	30	33	15	
17	1.2	29	36	37	30	33	15	
18	.8	30	37	39	33	30	15	
19	.6	32	28	36	32	30	15	
20	.2	33	20	34	35	30	16	
21	.5	32	20	34	35	24	16	
22	1.1	32	20	28	34	17	15	
23	2.1	32	19	25	36	18	16	
25	1.9	32	21	31	40	19	15	
25	.6	32	23	33	40	19	15	
26	.6	32	23	32	39	19	15	
27	.6	33	22	33	36	18	15	
28	.6	33	26	33	34	17	16	
29	.6	33	30	33	35	16	19	
30	.6	34	31	33	38	16	19	
31	.6		31		38	15		

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	0.5	49	29	29	28	34	16	24	47	34	31	34	25
2	.5	48	27	30	28	35	17	25	46	34	28	32	25
3	.5	49	24	29	29	36	18	25	47	33	27	31	25
4	.5	48	28	31	29	35	19	23	45	35	27	31	25
5	.5	49	36	31	30	34	20	23	43	34	28	31	21
6	.5	49	41	32	32	33	21	23	43	36	27	33	17
7	.5	51	42	33	31	33	22	27	42	33	28	32	17
8	.5	51	43	35	31	37	23	30	43	23	28	31	16
9	.5	51	43	33	30	36	24	31	38	16	28	31	15
10	.5	48	44	32	29	34	25	39	32	16	28	32	15
11	.5	45	39	31	29	32	26	45	25	26	28	33	13
12	5	45	39	32	31	30	27	45	22	30	32	36	12
13	17	41	42	32	35	28	28	48	21	31	30	37	12
14	21	40	40	32	35	26	29	51	20	31	28	37	11
15	23	44	36	31	34	24	30	51	21	31	29	35	8
							31		26		28	35	

NOTE.—No gage record, discharge interpolated, Sept. 9–14, 1916.

Monthly discharge of Elsinore canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Mean discharge in (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge in (second-feet).	Run-off (total in acre-feet).
1915.			1916.		
March 8-31	1.0	48	April	19.4	1,150
April	25.1	1,490	May	40.9	2,510
May	27.5	1,690	June	33.2	1,980
June	30.7	1,830	July	29.9	1,840
July	33.7	2,070	August	32.0	1,970
August	27.4	1,680	September	24.8	1,480
September	15.4	916			
October 1-11	11.8	258			

BROOKLYN CANAL NEAR ELSINORE, UTAH.

LOCATION.—In sec. 6, T. 25 S., R. 3 W., about a quarter of a mile below head of canal and 2½ miles southwest of Elsinore, Sevier County.

RECORDS AVAILABLE.—April 13, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder on left bank, with outside and inside staff gages.

DISCHARGE MEASUREMENTS.—Made from bridge 75 feet above gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Concrete weir with flashboard 200 feet below gage serves as control.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation changed slightly several times during 1915 by accumulation of sand behind control crest; permanent during 1916. Rating curves well defined. Operation of water-stage recorder satisfactory throughout each season. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Canal diverts water from right bank of Sevier River near the Denver & Rio Grande Railroad bridge over the river south of Elsinore, in sec. 6, T. 25 S., R. 3 W. Water used for irrigation east of Elsinore.

Discharge measurements of Brooklyn canal near Elsinore, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 9	1.17	4.1	Aug. 30	1.55	16.6	Apr. 26	2.92	75.0
Apr. 24	2.32	51				do	1.55	17.5
May 8	2.27	45.2	1916.			May 27	2.74	71.5
June 9	2.42	54	Mar. 7	1.18	5.2	June 21	2.26	46.8
25	2.28	47.6	Apr. 7	1.95	32.0	Aug. 5	2.14	38.7
July 7	2.34	48.2	24	2.43	53.0	Sept. 19	2.08	36.8
22	1.92	28.3						

Daily discharge, in second-feet, of Brooklyn canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	42	9	15	17	16
2	41	10	15	18	32
3	42	11	15	19	44
4	42	12	15	20	50
5	42	13	15	21	50
6	28	14	15	22	50
7	15	15	14	23	90
8	15	16	14		

Daily discharge, in second-feet, of Brooklyn canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Mar	Apr.	May	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	14	48	56	48	32	19	15
2	....	16	48	60	48	32	19	15
3	....	29	46	58	47	32	20	15
4	....	28	44	58	47	32	20	14
5	....	26	45	56	48	31	19	15
6	....	25	44	56	48	32	19	20
7	....	30	44	56	48	31	19	20
8	4.0	37	44	56	48	32	19	20
9	4.2	36	49	56	47	32	19	17
10	4.2	35	58	58	47	33	19	16
11	4.4	35	58	58	47	33	20	22
12	3.0	34	60	56	47	32	20	....
13	1.6	34	58	56	44	31	21	....
14	4.6	32	61	49	34	31	21	....
15	5.0	31	62	44	34	31	20	....
16	5.3	30	62	46	33	32	21	....
17	8.0	29	64	47	31	31	21	....
18	7.1	29	65	46	29	31	20	....
19	5.0	36	51	48	30	31	20	....
20	5.0	51	37	49	30	31	20	....
21	4.4	52	37	49	30	26	20	....
22	4.0	50	46	49	30	16	20	....
23	4.2	51	48	48	30	17	25	....
24	1.4	55	49	48	31	17	45	....
25	.7	59	51	48	31	16	46	....
26	.5	59	53	48	31	16	33	....
27	6.1	52	54	50	34	17	16	....
28	18.0	46	53	50	33	17	15	....
29	10.6	47	52	50	33	16	15	....
30	4.0	47	52	48	33	17	15	....
31	11.0	....	53	....	33	17	....	....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							
1	....	20	88	60	40	41	40
2	....	19	85	54	38	41	39
3	....	18	86	44	38	41	38
4	....	14	84	43	40	41	38
5	....	13	83	49	40	41	38
6	....	22	84	49	38	43	38
7	....	25	85	49	38	43	37
8	....	32	92	49	39	42	39
9	....	32	85	50	39	41	40
10	....	31	86	53	39	41	40
11	....	30	86	53	38	41	40
12	....	29	86	50	38	42	40
13	....	31	82	50	38	44	41
14	....	32	78	48	38	45	40
15	6	34	77	41	38	50	39
16	11	36	76	41	38	50	40
17	17	38	78	46	36	48	39
18	17	41	86	45	35	48	39
19	17	41	74	47	36	48	38
20	25	41	70	46	36	48	40
21	34	46	70	46	36	48	41
22	31	52	70	44	37	48	39
23	22	52	70	42	37	44	39
24	22	54	70	44	37	40	38
25	22	66	70	41	38	40	36
26	22	74	70	39	38	40	36
27	22	82	70	40	41	40	36
28	22	96	64	39	41	39	35
29	21	88	61	38	41	39	35
30	21	88	61	39	41	40	34
31	20	....	61	....	41	40	....

NOTE.—1915: Stage-discharge relation affected by backwater for part of the day, due to check below control employed to supply water to a small lateral, discharge estimated, Mar. 31, Apr. 12–13, May 3, 15, 26, June 8, 20, July 4, 15, 28, Aug. 6, 17, 31, Sept. 27.

Monthly discharge of Brooklyn canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-23	31.2	1,420	October 1-11	17.2	375
1915.			1916.		
March 8-31	5.3	251	March 15-31	20.9	705
April	37.8	2,250	April	42.5	2,530
May	51.5	3,170	May	76.9	4,730
June	51.9	3,090	June	46.0	2,740
July	38.2	2,350	July	38.3	2,360
August	26.6	1,640	August	43.1	2,650
September	21.5	1,280	September	38.4	2,280

RICHFIELD CANAL NEAR ELSINORE, UTAH.

Location.—In NE. ¼ sec. 6, T. 25 S., R. 3 W., 200 feet below head of canal and 2 miles southwest of Elsinore, Sevier County.

Records available.—April 11, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

Discharge measurements.—Made by wading 75 feet above gage.

Channel and control.—Bed composed of gravel and sand. Concrete weir, with removable flashboards, 10 feet below gage, served as control until May 10, 1916, when permanent crest was installed.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed during 1915 season by accumulation of sand back of control crest and changing of flashboards on control. Dates of change in conditions are accurately known from discharge measurements, gage records, and information furnished by water master. Several rating curves used for 1915; two well-defined curves for 1916. Water-stage recorder operated satisfactorily. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records for 1915 good; for 1916 excellent.

Canal diverts water from left bank of Sevier River a short distance below the Denver & Rio Grande Railroad bridge south of Elsinore, in the NW. ¼ sec. 6, T. 25 S., R. 3 W. Water used for irrigation in Sevier Valley west of the river near Elsinore.

Discharge measurements of Richfield canal near Elsinore, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 8	1.30	[a]0.6	July 22	2.36	92	Apr. 26	1.37	18.3
Apr. 23	1.86	111	Aug. 19	1.45	78	May 17	2.36	115
May 8	2.08	76	30	1.24	56	27	2.18	95
26	2.38	78	Sept. 18	1.40	70	June 21	2.34	104
27	2.43	106	Oct. 12	1.20	52	July 3	2.10	82
27	2.04	64				Aug. 5	2.19	95
27	1.56	20.6	1916.			Sept. 19	1.47	23.8
June 9	2.39	102	Mar. 7	.76	23.4	19	1.75	47.2
25	2.37	97	Apr. 26	2.30	108	19	2.00	74
July 8	2.55	116	26	2.17	87			
21	2.40	98	26	1.82	57			

[a] Estimated.

Daily discharge, in second-feet, of Richfield canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Day.	Oct.	Day.	Oct.
1914.		1914.		1914.	
1	35	9	43	17	20
2	31	10	35	18	20
3	47	11	33	19	18
4	52	12	31	20	18
5	43	13	29	21	17
6	41	14	26	22	17
7	43	15	21	23	20
8	44	16	20	24	23

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	34	108	111	104	92	60	57
2	....	60	107	111	101	91	60	56
3	....	90	....	94	98	93	74	50
4	....	69	....	74	97	90	80	30
5	....	59	....	16	119	84	74	28
6	....	55	....	77	115	85	72	23
7	....	46	....	77	115	85	70	23
8	0.6	46	76	78	113	....	66	24
9	.6	92	30	99	106	....	69	30
10	.6	102	....	111	106	....	68	62
11	.6	99	....	112	107	....	68	57
12	.6	93	....	104	107	....	74	54
13	....	110	....	97	100	....	74	....
14	....	102	....	89	91	....	74	....
15	....	93	....	88	90	....	74	....
16	....	94	16	98	89	81	71	....
17	....	91	74	100	88	78	70	....
18	....	88	87	99	89	74	70	....
19	....	97	100	108	92	75	70	....
20	12	116	80	111	94	72	66	....
21	22	116	88	113	96	68	62	....
22	22	121	87	116	92	68	60	....
23	29	112	77	111	94	65	50	....
24	50	105	74	109	102	66	8	....
25	46	111	80	106	103	67	8	....
26	42	110	82	108	102	67	27	....
27	38	108	105	111	109	67	56	....
28	34	103	103	111	98	61	60	....
29	34	105	94	107	96	58	59	....
30	34	109	100	106	96	58	59	....
31	34	....	101	....	94	61	....	....

Daily discharge, in second-feet, of Richfield canal near Elsinore, Utah, for the year ending Sept. 30, 1915 and 1916—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							
1			106	106	81	99	86
2			102	106	85	95	85
3			106	104	90	98	79
4			106	93	95	100	81
5			106	121	99	96	75
6			107	121	91	101	71
7	23		110	121	91	81	67
8	18		118	126	106	80	80
9	10		126	130	100	75	87
10	8	2	130	134	95	72	86
11	8	12	131	113	88	72	82
12	8	29	147	102	90	75	81
13	8	48	144	88	88	79	84
14	8	67	122	85	90	73	79
15	8	87	116	98	91	80	71
16	8	93	117	98	86	87	79
17	8	99	116	104	80	81	80
18	9	60	121	104	72	85	78
19	16	46	113	106	75	93	74
20	12	81	111	106	80	88	92
21	10	96	107	108	80	99	94
22		99	106	104	81	96	90
23		102	100	101	83	90	86
24		102	83	104	84	84	78
25		101	75	104	86	83	73
26		107	70	94	91	80	71
27		81	82	95	104	80	70
28		112	84	95	101	79	67
29		112	106	93	98	78	65
30		113	106	88	100	86	66
31			105		100	88	

Note.—1915: Daily discharge estimated Mar. 13–19, 0.6 second-foot; May 3–7, 85 second-feet; May 10–15, 1 second-foot; Aug. 8–15, 83 second-feet; and Mar. 20, 25–27, 30–31, Apr. 1–2, Sept. 6–7, as given in table. Canal head gates closed Mar. 8–19, May 10–15. 1916: No flow Mar. 22 to Apr. 9.

Monthly discharge of Richfield canal near Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1916.		
October 1–24	30.3	1,440	March 7–31	6.5	321
1915.			April	55.0	3,270
March 8–31	16.8	800	May	109	6,700
April	91.2	5,430	June	105	6,250
May	67.7	4,160	July	89.7	5,520
June	98.2	5,840	August	85.6	5,260
July	100	6,150	September	78.6	4,680
August	76.4	4,700			
September	61.8	3,680			
October 1–12	41.2	980			

ANNABELLA CANAL AT ELSINORE, UTAH.

Location.—In NW. ¼ sec. 33, T. 24 S., R. 3 W., about 400 yards below head of canal and a mile southeast of Denver & Rio Grande Railroad station at Elsinore, Sevier County.

Records available.—April 11, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder with outside and inside staff gages.

Discharge measurements.—Made by wading 150 feet below gage.

Channel and control.—Bed composed of sand and gravel. Concrete weir 10 feet below gage serves as control.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory during irrigation seasons of both 1915 and 1916. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent.

Canal diverts water from right bank of Sevier River in the NW. ¼ sec. 33, T. 25 S., R. 3 W. Water is used for irrigation in Sevier Valley east of the river and below Elsinore.

Discharge measurements of Annabella canal at Elsinore, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Mar. 9	0.46	3.7	July 8	1.37	43.8	June 6	1.43	38.6
Apr. 25	1.36	44.5	21	1.08	26.0	6	1.44	39.6
May 8	1.36	43.9	Aug. 30	.72	11.6	21	1.16	31.1
June 10	1.31	40.5	Sept. 18	.82	14.6	July 3	.98	22.4
25	1.26	36.4				Aug. 4	1.04	26.0
27	1.15	29.8	1916.			15	.96	21.2
28	1.18	32.3	Mar. 9	.40	3.0	Sept. 19	.93	21.3
			Apr. 27	1.28	38.0			

Daily discharge, in second-feet, of Annabella canal at Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	October.	Day.	October.	Day.	October.
1914.		1914.		1914.	
1	15	9	15	17	13
2	15	10	15	18	13
3	14	11	15	19	13
4	14	12	13	20	13
5	14	13	13	21	13
6	14	14	13	22	13
7	14	15	13	23	11
8	14	16	13		

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1		14	44	40	30	29	9	14
2		16	46	42	28	26	10	13
3		22	26	44	31	27	16	12
4		22	24	51	30	26	20	11
5		21	41	50	47	22	18	10
6		20	42	46	46	23	16	10
7		20	44	43	45	24	16	9
8		20	44	40	44	22	15	9
9	3.8	18	46	36	39	22	15	9
10	4.3	16	45	40	38	22	15	9
11	4.3	10	45	41	36	24	16	9
12	5.2	14	46	37	38	22	16	
13	6.6	17	46	26	32	19	16	
14	6.3	19	46	29	26	21	16	
15	2.4	20	48	29	25	22	16	
16		20	47	33	26	26	15	
17		22	41	36	24	26	15	
18		26	42	30	24	25	15	
19		33	30	36	24	24	16	
20		39	19	47	24	22	14	
21		40	19	48	26	19	14	
22		41	19	49	25	19	15	
23		45	19	49	26	16	21	
24		44	19	44	31	16	24	
25		44	18	43	31	14	23	
26		44	26	33	31	15	22	
27		44	32	24	33	15	18	
28		41	30	12	29	12	16	
29		41	34	32	29	11	15	
30	9.4	43	36	29	29	12	13	
31	16.0		38		30	18		

Daily discharge, in second feet, of Annabella canal at Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							16	24	54	30	24	24	22
1	0.5	44	34	18	28	24	17	24	43	23	20	24	22
2	.5	42	30	20	28	24	18	25	50	5	18	24	22
3	.5	44	16	22	26	21	19	26	42	26	18	24	21
4	.5	42	10	26	25	22	20	25	30	31	19	22	22
5	.5	43	18	28	26	20	21	22	30	31	20	24	24
6	4	45	32	24	26	18	22	24	28	30	22	20	24
7	10	50	37	24	24	17	23	25	28	28	21	20	18
8	9	56	35	30	24	22	24	27	32	29	20	20	14
9	22	52	39	28	24	26	25	32	34	30	20	18	14
10	28	56	52	30	24	26	26	36	26	30	22	16	16
11	26	59	56	26	24	26	27	39	14	32	8	18	18
12	26	57	52	26	25	22	28	38	18	30	4	17	18
13	22	54	52	25	26	24	29	41	16	26	22	17	18
14	22	56	35	26	25	22	30	42	26	22	25	20	17
15	24	56	22	26	23	21	31	......	39	......	26	22	......

Note.—1915: Clock of recording gage stopped, discharge estimated from range of stage recorded May 28 to June 3, June 7, 9, July 7, Aug. 31, Sept. 2-3, 7, 9-11, 26-29. No flow Mar. 16-29. 1916: No gage height record, discharge estimated, Apr. 15-19, July 19-21. Temporary change in control, discharge determined from parallel rating curve June 6-14.

Monthly discharge of Annabella canal at Elsinore, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1914.			1915.		
October 1-23	13.6	620	September	16.2	964
1915.			October 1-11	10.4	227
March 9-31	2.5	115	1916.		
April	27.9	1,660	April	21.5	1,280
May	35.6	2,190	May	40.8	2,510
June	38.0	2,260	June	30.7	1,830
July	31.5	1,940	July	22.1	1,360
August	20.7	1,270	August	22.9	1,410
			September	20.9	1,240

VERMILION CANAL NEAR RICHFIELD, UTAH.

Location.—In NW. ¼ sec. 32, T. 23 S., R. 2 W., 500 feet below head of canal and 2½ miles east of Richfield, Sevier County.

Records available.—April 10, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

Discharge measurements.—Made by wading or from bridge a quarter of a mile below gage.

Channel and control.—Bed composed of sandy loam. Concrete weir 10 feet below gage serves as nominal control, but owing to the light grade of the canal, growth of moss and deposits of sand cause changes in the rating.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed frequently during season of 1915, but remained permanent during season of 1916. Several rather poorly defined rating curves used for 1915, well-defined curve used for 1916. Operation of water-stage recorder satisfactory throughout each season. Daily discharge ascertained by applying to rating table, either directly or by shifting-control method, the mean daily gage height determined by inspecting recorder graph. Records good.

Canal diverts water from left bank of Sevier River in the NW. ¼ sec. 32, T. 23 S., R. 4 W. Water used for irrigation in Sevier Valley west of the river and northeast of Richfield, toward Vermilion.

Discharge measurements of Vermilion canal near Richfield, Utah, during the years ending Sept. 30, 1915 and 1916.

[Made by J. J. Sanford.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915.	*Feet.*	*Sec.-ft.*	1915.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Apr. 22	1.69	73	Aug. 14	2.05	73	June 6	1.87	87
May 7	1.53	69	30	1.63	55	21	1.52	60
June 10	1.83	84	Oct. 11	1.88	64	July 3	1.74	64
23	1.85	83				20	1.91	58
July 8	2.04	79	1916.			Aug. 4	2.26	62
8	2.04	83	Mar. 10	.06	1.0	14	2.20	64
8	2.04	86	27	.92	36.8	Sept. 7	2.02	68
20	1.81	67	May 1	1.68	73	19	1.60	53
21	1.87	67	13	2.00	93			
Aug. 4	2.17	81	25	1.83	82			

Daily discharge, in second-feet, of Vermilion canal near Richfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1		24	84	77	77	86	57	73
2		21	88	101	80	85	63	71
3		69	69	108	75	80	71	72
4		100	77	104	72	80	79	73
5		57	74	77	75	76	75	72
6		67	66	73	88	74	70	70
7		63	70	73	89	85	65	66
8		54	71	73	82	83	68	66
9		57	69	73	83	79	64	66
10		53	72	73	77	80	60	66
11		33	81	93	70	77	69	66
12		39	89	89	72	81	64	
13		42	92	83	68	76	66	
14		54	95	79	69	74	70	
15		58	96	80	67	72	74	
16		57	99	77	70	70	71	
17		55	94	83	70	80	70	
18		57	112	83	71	70	67	
19		58	119	78	64	64	66	
20		64	98	77	63	62	64	
21		79	86	84	67	68	62	
22		73	85	87	66	62	60	
23		69	81	85	63	59	61	
24	0	68	66	84	72	58	64	
25	0	71	65	68	77	57	67	
26	0	65	96	74	80	55	69	
27	0	59	105	74	86	56	62	
28	0	55	87	91	86	56	63	
29	0	50	75	84	82	56	66	
30	0	71	76	74	84	56	73	
31	13		83		85	58		

Daily discharge, in second-feet, of Vermilion canal near Richfield, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							
1	....	41	76	80	65	72	54
2	....	36	72	78	66	65	64
3	....	29	72	68	65	59	70
4	....	8	73	71	52	60	68
5	....	3	70	70	48	68	68
6	....	18	72	80	51	62	70
7	....	38	75	94	54	46	68
8	....	32	78	95	56	46	68
9	....	31	88	100	51	53	76
10	1	31	96	97	50	50	74
11	1	28	99	108	48	46	74
12	1	24	96	105	72	42	75
13	1	30	92	95	73	64	74
14	1	38	94	94	74	65	71
15	1	57	94	83	75	60	74
16	1	59	92	76	72	50	70
17	1	62	90	74	62	43	68
18	1	64	90	79	62	48	62
19	1	70	92	74	65	68	54
20	1	60	82	66	58	62	53
21	17	54	82	64	56	62	71
22	32	52	80	78	57	67	74
23	32	54	80	83	66	58	80
24	34	60	80	79	72	56	88
25	32	61	82	82	74	56	84
26	33	63	84	78	67	57	78
27	36	64	80	74	68	51	79
28	38	113	78	69	68	52	84
29	38	81	80	67	56	54	86
30	39	74	78	66	52	56	86
31	42	....	76	....	54	63	....

Monthly discharge of Vermilion canal near Richfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
March 24-31	1.6	26	March 10-31	17.5	764
April	58.1	3,460	April	47.8	2,840
May	84.5	5,200	May	83.0	5,100
June	82.0	4,880	June	80.9	4,810
July	75.2	4,620	July	61.6	3,790
August	70.2	4,320	August	56.8	3,490
September	66.7	3,970	September	72.2	4,300
October 1-11	69.2	1,510			

ROCKYFORD CANAL NEAR VERMILION, UTAH.

Location.—In NE. ¼ sec. 19, T. 22 S., R. 1 W., at highway bridge about a quarter of a mile below head of canal and 2 miles northeast of Vermilion, Sevier County.

Records available.—July 8, 1914, to September 30, 1916.

Gage.—Vertical staff nailed to right bridge abutment; read by Earl Thalman and Mrs. Will Barron.

Discharge measurements.—Made from highway bridge at gage or by wading.

Channel and control.—Bed composed of gravel and clay; fairly permanent.

Ice.—Conditions not known.

Diversions.—Not known.

Regulation.—Flow controlled by head gates.

Accuracy.—During 1915 stage-discharge relation changed several times; rating curves poorly defined; for 1916 one fairly well-defined curve used throughout season, except for a part of August and September, when changes in control occurred. Gage read daily to tenths during irrigation season and several times a week during remainder of year. Daily discharge ascertained by applying daily gage height to rating table, either directly or by shifting-control method. Records for 1915 fair; for 1916, good.

Canal diverts water from Rockyford reservoir, a small reservoir on Sevier River at Vermilion, in sec. 19, T. 22 S., R. 2 W. Flow dependent on water stored in reservoir and seepage and return waters below Richfield. Water used for irrigation north of Vermilion.

Discharge measurements of Rockyford canal near Vermilion, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*	1915.		*Feet.*	*Sec.-ft.*
Oct. 28	J. J. Sanford	2.00	44.4	Oct. 26	J. J. Sanford	1.72	47.6
				Dec. 14	A. B. Purton	1.56	39.8
1915.							
Mar. 24	.....do	1.66	35.2	1916.			
May 6	J. C. Dort	2.48	70	Jan. 22	J. J. Sanford	1.42	34.3
7	J. J. Sanford	2.47	70	Mar. 6	.....do	2.12	67
June 1	J. C. Dort	2.58	73	28	.....do	1.80	48.8
11	J. J. Sanford	2.28	75	Apr. 10	.....do	2.20	68
23	.....do	2.51	87	May 15	.....do	2.47	83
July 9	.....do	2.54	81	25	.....do	2.47	85
20	.....do	2.68	92	June 9	.....do	2.72	94
Aug. 14	.....do	2.48	84	July 7	.....do	2.54	86
23	J. C. Dort	2.54	88	Aug. 14	.....do	2.28	82
Sept. 4	J. J. Sanford	2.74	88	Sept. 9	.....do	2.76	88

Daily discharge, in second-feet, of Rockyford canal near Vermilion, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	39	44	25	17	......	12	59	92	74	83	91	79
2	39	44	23	17	......	15	54	90	74	83	92	79
3	40	43	23	17	......	15	56	85	78	83	93	83
4	42	41	23	17	......	15	56	85	78	83	93	89
5	44	41	23	17	......	15	70	70	78	83	92	90
6	44	41	23	17	......	15	69	70	78	83	91	88
7	44	41	23	17	......	15	64	68	78	81	91	85
8	44	41	23	9	......	15	63	69	0	80	91	82
9	45	41	23	......	......	15	64	69	0	79	90	83
10	45	40	22	......	......	25	56	69	0	79	86	83
11	45	25	22	......	......	38	54	70	40	78	86	83
12	44	......	22	......	......	38	52	74	87	78	86	83
13	44	......	22	......	......	38	51	75	87	79	86	83
14	44	......	22	......	......	38	50	75	88	79	86	83
15	44	......	22	......	......	38	50	75	88	79	86	86
16	44	......	21	......	......	38	51	75	88	79	86	87
17	44	......	21	......	4	38	51	75	88	102	86	78
18	44	......	22	......	9	38	50	74	88	100	86	88
19	44	......	21	......	9	38	50	75	88	98	86	67
20	44	......	21	......	9	38	82	75	88	98	86	71
21	43	......	18	......	9	36	75	76	87	99	86	71
22	44	......	15	......	9	35	68	78	86	99	86	66
23	44	......	17	......	9	35	68	78	86	91	87	66
24	44	14	17	......	9	34	71	78	86	87	86	61
25	44	32	17	......	10	52	73	77	86	87	86	61
26	44	32	16	......	9	52	84	77	87	87	88	61
27	44	32	17	......	9	52	84	76	86	89	82	61
28	44	32	17	......	9	52	83	75	85	96	81	61
29	44	33	17	......	......	64	83	74	85	90	76	59
30	44	33	16	......	......	65	85	74	85	91	80	59
31	44	......	16	......	......	61	......	74	......	91	80	......

Daily discharge, in second-feet, of Rockyford canal near Vermilion, Utah, for the years ending Sept., 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.												
1	53	43	40	35	26	52	49	96	40	90	70	69
2	53	44	39	38	26	52	49	96	79	90	70	68
3	54	45	39	38	26	55	50	96	79	90	70	68
4	53	47	40	38	27	58	50	96	96	90	70	66
5	55	49	40	37	27	62	45	85	96	90	70	66
6	54	50	39	38	28	66	40	79	96	90	70	65
7	53	52	39	37	27	61	52	79	96	90	71	77
8	55	54	39	35	29	56	69	85	96	90	71	85
9	56	54	40	36	31	51	69	90	96	90	72	74
10	56	54	40	37	30	52	69	90	96	90	85	64
11	55	54	40	36	28	54	69	90	74	90	100	64
12	55	53	40	34	27	54	69	90	74	91	100	64
13	41	44	40	34	26	54	69	90	74	91	83	64
14	40	43	40	35	25	54	69	90	74	91	83	64
15	43	43	39	34	26	54	64	88	74	91	82	65
16	43	43	38	35	26	54	64	85	74	92	81	65
17	45	43	38	35	34	54	64	85	74	92	72	66
18	49	42	37	35	42	54	64	85	90	92	64	66
19	53	42	33	34	49	54	64	85	90	92	54	66
20	50	43	34	35	49	52	64	85	90	93	53	66
21	53	43	35	36	48	50	62	85	90	93	52	66
22	54	42	36	35	48	47	59	79	90	94	51	66
23	54	42	37	34	48	47	74	79	90	94	51	67
24	51	42	37	35	48	47	90	79	90	100	50	67
25	46	40	37	36	48	47	90	79	90	100	50	68
26	46	40	37	36	48	47	90	79	90	95	73	68
27	45	40	37	37	49	48	90	79	90	95	73	68
28	43	39	35	31	50	48	90	79	90	95	72	68
29	43	39	35	28	51	48	90	85	90	95	71	68
30	43	40	33	29	......	48	90	20	90	69	70	45
31	43	......	35	26	......	48	......	0	......	69	69	......

NOTE.—1914-15: Water surface below gage, discharge estimated, Nov. 12–23 and Jan. 9–31, 2 second-feet; Feb. 1–16, 3 second-feet. No gage-height record, discharge estimated, Jan. 6–8, Feb. 17, Mar. 22–23. 1915–16: No gage-height record, discharge interpolated, Nov. 17–18, 22, 27, 30, Dec. 11, Jan. 4, 11, 25, Feb. 1, 8, 12–13, 15, 17–18, 20–21, 23–24, 26, 28–29, Mar. 1, 3–5, 7–8, 10, 13–14, 16–17, 20–21, 23–24, 26–27, 29–30, Apr. 1–3. Estimated May 30 to June 1.

Monthly discharge of Rockyford canal near Vermilion, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1914–15.				
October	45	39	43.5	2,670
November	44	2	22.5	1,340
December	25	15	20.3	1,250
January	17	2	5.6	345
February	10	....	5.4	302
March	65	12	34.7	2,130
April	85	50	64.2	3,820
May	92	68	75.7	4,650
June	88	0	74.2	4,420
July	102	78	86.7	5,330
August	93	76	86.5	5,320
September	90	59	75.9	4,520
The year	102	0	49.9	36,100
1915–16.				
October	56	40	49.6	3,050
November	54	39	45.0	2,680
December	40	33	37.7	2,320
January	38	26	34.8	2,140
February	51	26	36.1	2,080
March	66	47	52.5	3,230
April	90	40	67.6	4,020
May	96	0	80.9	4,970
June	90	40	85.3	5,080
July	100	69	90.8	5,580
August	100	50	70.1	4,310
September	85	45	66.8	3,970
The year	100	0	59.8	43,400

SALINA CREEK AT SALINA, UTAH.

Location.—In NW. ¼ sec. 25, T. 21 S., R. 1 W., at bridge south of hotel at Salina, Sevier County, about a mile above mouth of creek.

Drainage area.—298 square miles (measured on topographic maps).

Records available.—April 25, 1914, to September 30, 1916. July 1 to December 31, 1900, at vertical staff gage about 5 miles southeast of Salina.

Gage.—March 23, 1915, to September 30, 1916, vertical staff gage nailed to right bridge abutment a quarter of a mile south of hotel; April 25, 1914, to March 22, 1915, vertical staff nailed to right abutment of bridge on depot road in SE. ¼ sec. 23. Gage reader, Deane Steele.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed composed of gravel; shifts during extreme high water.

Extremes of discharge.—1914–1916: Maximum stage recorded, 5.20 feet May 22, 1914 (discharge, 270 second-feet); no flow at times.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Below all diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation changed frequently. Owing to unreliability of gage-height record and instability of control, determination of daily discharge not made for this station; record of monthly discharge for 1916 roughly approximate only. Stream practically dry at mouth from about the middle of June to September, except for sudden floods caused by local rainstorms.

Discharge measurements of Salina Creek at Salina, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 14	A. B. Purton	1.08	7.3	Apr. 28	J. J. Sanford	1.82	52
Jan. 22	J. J. Sanford	3.00	21.5	May 15	.....do	1.00	14.5
Feb. 18	.....do	1.24	14.4	June 19	.....do	.59	1.3
Mar. 10	.....do	1.52	30.2	July 6	.....do	.59	1.2
28	.....do	1.46	30.1	7	.....do	.58	1.2
Apr. 13	E. A. Porter	.79	.8	Aug. 14	.....do	.42	.4
18	J. J. Sanford	1.08	6.5	Sept. 9	.....do	1.24	52

Monthly discharge of Salina Creek at Salina, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1.5	0.2	0.4	20
November	24.0	.3	6.5	390
December			[a] 10.4	640
January			[a] 18.0	1,110
February			[a] 14.0	800
March	76	9.7	25.9	1,590
April	72	1.5	10.9	650
May	135	22	64.6	3,970
June	50	.7	6.6	390
July	56	1.4	6.0	370
August	300	0	9.4	580
September			6.6	390
The year				10,900

[a] Estimated; stage-discharge relation affected by ice.

WEST VIEW CANAL AT REDMOND, UTAH.

Location.—In NW. ¼ sec. 7, T. 21 S., R. 1 E., about 100 yards above bridge, where depot road crosses canal, at southeast corner of Redmond, Sevier County, about three-quarters of a mile below head of canal.

Records available.—April 22, 1914, to September 30, 1916, during irrigation season only.

Gage.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

Discharge measurements.—Made by wading just below gage.

Channel and control.—Earth section; wooden submerged weir at head of wooden flume 30 feet below gage acts as nominal control, though filling in of sand behind the weir causes changes in stage-discharge relation.

Diversions.—Not known.

Regulation.—Flow controlled by head gates

Accuracy.—Stage-discharge relation changed several times during seasons of 1915 and 1916, due to manipulation of weir crest and filling in of sand. Several rating curves poorly defined at lower stages. Water-stage recorder gave satisfactory gage-height record throughout each irrigation season. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph, except for days of considerable variation, for which the means of hourly discharge were used. Records fair.

Canal diverts water from left bank of Sevier River in the SW. ¼ sec. 7, T. 21 S., R. 1 E. Water is used for irrigation west of river and below Redmond.

Discharge measurements of West View canal at Redmond, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Mar. 5	L. W. Jordan	4.66	13.7	Apr. 2	E. A. Porter	5.17	21.4
22	J. J. Sanford	5.36	29.6	18	Sanford and Jacob	5.56	27.8
Apr. 24	J. C. Dort	5.39	27.2	May 12	E. A. Porter	5.68	31.2
May 6	.....do	5.58	31.3	27	.....do	5.49	28.2
June 2	.....do	5.59	31.2	June 3	.....do	5.35	25.4
28	.....do	5.22	25.3	10	.....do	5.14	20.0
28	.....do	4.54	12.3	27	.....do	4.88	12.5
July 8	.....do	4.36	7.8	July 15	.....do	5.12	17.8
28	.....do	4.39	8.4	19	.....do	5.26	22.3
Aug. 2	.....do	4.49	10.7	Aug. 17	.....do	5.58	29.0
16	.....do	4.36	8.7	28	.....do	5.25	23.0
30	.....do	4.34	8.2	Sept. 10	.....do	5.21	22.6
Sept. 13	.....do	4.43	10.2	18	J. J. Sanford	5.26	24.2
Oct. 5	L. W. Jordan	4.55	11.3				

Daily discharge, in second-feet, of West View canal at Redmond, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	32	30	11	14	7.4	8.3	11
2	....	30	31	26	14	11	8.3	22
3	....	30	32	30	11	12	9.2	28
4	....	8.5	31	32	14	13	8.5	19
5	16	4.7	31	27	12	14	7.7	12
6	21	0	31	28	13	16	7.9	....
7	20	2.1	30	27	9.0	15	8.3	....
9	17	0	30	34	7.2	14	9.2	....
9	17	14	29	32	9.8	14	9.0	....
10	21	25	27	20	12	12	9.8	....
11	24	20	27	25	13	12	11	....
12	27	21	29	24	16	12	10	....
13	27	21	32	25	17	9.4	9.6	....
14	27	19	29	14	15	7.6	9.8	....
15	28	20	27	11	18	0	10	....
16	30	23	28	22	19	.8	10	....
17	28	24	33	27	14	1.2	11	....
18	30	26	33	25	12	4.1	11	....
19	30	26	32	26	13	10	11	....
20	30	16	30	25	14	11	11	....
21	28	15	28	25	14	11	11	....
22	28	19	28	19	14	9.4	11	....
23	27	28	24	18	13	8.6	9.8	....
24	27	31	33	21	14	6.5	10	....
25	27	30	34	20	16	5.8	10	....
26	28	12	30	16	20	5.9	10	....
27	31	10	28	22	17	6.3	9.8	....
28	33	27	30	19	8.1	6.7	9.8	....
29	18	32	29	14	7.0	7.4	10	....
30	0	31	30	12	9.2	8.1	10	....
31	21	....	25	....	7.9	9.4	....	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	20	24	11	15	24	23	16	23	32	15	19	30	24
2	23	27	10	17	23	22	17	25	30	11	22	28	23
3	16	27	13	16	20	20	18	27	19	9	18	23	24
4	14	25	26	18	19	20	19	30	31	11	18	16	24
5	14	28	28	20	22	20	20	31	28	12	17	27	24
6	9	28	25	30	16	18	21	5	24	11	16	30	23
7	12	26	20	22	32	18	22	25	31	10	14	35	25
8	21	29	20	20	30	19	23	4	34	13	19	35	32
9	8	36	18	20	27	21	24	7	35	11	21	31	27
10	0	31	22	14	32	22	25	0	31	13	21	29	16
11	0	32	31	18	27	23	26	0	26	9	18	28	16
12	0	32	32	16	23	25	27	22	28	14	16	24	16
13	15	32	30	27	26	27	28	28	30	16	22	23	13
14	14	30	24	21	27	26	29	28	25	18	17	24	20
15	18	29	19	18	28	23	30	26	21	19	20	24	26
							31	......	12	......	24	23	......

Monthly discharge of West View canal at Redmond, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
March 5-31	24.5	1,310	April	15.5	920
April	19.9	1,180	May	28.2	1,730
May	30.0	1,840	June	17.4	1,030
June	22.6	1,340	July	19.2	1,180
July	13.1	810	August	26.0	1,600
August	9.1	560	September	22.0	1,310
September	9.7	580			
October 1-5	18.4	180			

FAYETTE CANAL NEAR CENTERFIELD, UTAH.

Location.—In SW. ¼ sec. 8, T. 20 S., R. 1 E., half a mile below head of canal, about 2 miles northwest of Axtel railroad station, and 4 miles south of Centerfield, Sanpete County.

Records available.—April 21, 1914, to September 30, 1916; irrigation seasons only.

Gage.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

Discharge measurements.—Made by wading.

Channel and control.—Earth section. Wooden flume with crest board at upper end, 50 feet below gage, serves as control; changed at times during irrigation season.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation changed during irrigation seasons of 1915 and 1916 through interference with crest of control by irrigators and through backwater from diversion checks below. Four fairly well-defined rating curves used during these seasons. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records good.

Canal diverts water from right bank of Sevier River in the NE. ¼ sec. 18, T. 20 S., R. 1 E. Water is used for irrigation east of river near Centerfield.

Discharge measurements of Fayette canal near Centerfield, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Mar. 4	L. W. Jordan	1.22	5.5	Apr. 6	E. A. Porter	1.74	29.0
Apr. 24	J. C. Dort	2.00	44.4	13	do	2.30	24.9
May 11	do	2.20	52	24	do	2.38	28.8
27	do	2.35	62	25	do	2.19	31.2
June 1	do	2.60	74	May 12	do	2.78	65
2	do	2.11	51	27	do	2.50	50
16	do	1.50	18.8	June 3	do	2.76	64
28	do	1.61	24.7	10	do	2.07	24.9
July 8	Porter and Dort	1.45	16.7	25	do	1.93	17.6
27	J. C. Dort	1.52	21.5	July 13	do	1.97	19.5
Aug. 2	do	1.71	24.6	Aug. 7	J. W. Thurston	2.14	29.8
30	do	1.66	22.4	Sept. 19	E. A. Porter	2.11	29.5
Sept. 13	do	1.52	18.4	25	do	2.27	38.8
Oct. 5	L. W. Jordan	2.48	58				

Daily discharge, in second-feet, of Fayette canal near Centerfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	5.0	74	56	28	22	21	15
2	....	5.9	62	48	26	23	25	15
3	....	5.9	69	72	27	24	28	58
4	5.4	12	74	59	29	24	38	58
5	5.4	12	72	36	26	22	30	58
6	5.0	7.7	54	36	26	22	29	....
7	4.5	8.2	57	35	22	26	28	....
8	4.5	6.8	56	62	18	24	26	....
9	4.5	6.8	54	82	16	23	26	....
10	4.5	7.3	56	60	16	26	28	....
11	5.0	9.6	55	56	16	25	26	....
12	4.1	9.6	55	60	16	26	20	....
13	3.7	9.1	57	68	16	22	19	....
14	3.2	11	56	36	18	18	18	....
15	3.2	11	48	20	18	15	18	....
16	4.5	9.6	44	20	18	16	17	....
17	4.1	24	46	24	20	13	16	....
18	3.7	50	46	25	19	14	16	....
19	3.2	52	46	26	18	13	18	....
20	3.2	41	50	27	19	12	18	....
21	3.2	38	52	27	18	12	18	....
22	3.7	30	52	28	18	12	18	....
23	4.1	34	30	27	17	14	18	....
24	3.7	42	44	26	16	18	16	....
25	3.2	40	72	26	18	18	16	....
26	2.8	41	72	27	20	18	16	....
27	4.1	60	66	28	20	20	16	....
28	4.1	46	60	24	20	19	15	....
29	9.6	52	62	25	20	17	14	....
30	6.3	76	64	29	21	21	14	....
31	5.4	....	67	....	22	22	....	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.						
1	45	38	42	24	18	25
2	43	39	64	22	25	26
3	63	42	62	22	29	24
4	51	31	41	21	37	23
5	39	48	36	21	38	23
6	30	52	28	21	39	22
7	21	53	27	20	37	23
8	24	54	30	20	42	23
9	25	64	27	35	42	23
10	26	69	27	43	42	22
11	30	67	36	29	45	26
12	30	66	28	20	40	30
13	28	65	25	20	40	30
14	28	60	28	24	38	30
15	30	59	28	22	38	31
16	24	57	26	16	41	31
17	29	57	23	15	40	31
18	30	56	22	18	40	30
19	28	56	23	20	38	30
20	26	66	22	22	37	30
21	28	63	23	18	37	30
22	28	57	21	15	39	32
23	28	60	21	14	41	35
24	28	60	20	14	40	37
25	26	58	19	18	38	39
26	36	52	23	20	39	40
27	36	50	26	22	34	40
28	40	51	26	19	26	40
29	42	47	26	18	26	39
30	38	47	34	17	26	42
31	......	34	......	16	25	......

Monthly discharge of Fayette canal near Centerfield, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
March 4-31	9.6	2.8	4.35	242
April	76	5	25.4	1,510
May	74	30	57.2	3,520
June	82	20	39.2	2,330
July	29	16	20.1	1,240
August	26	12	19.4	1,190
September	38	14	20.9	1,240
October 1-5	58	15	40.8	404
1916.				
April	63	21	32.7	1,950
May	69	31	54.1	3,330
June	64	19	29.5	1,760
July	43	14	20.8	1,280
August	45	18	36.0	2,210
September	42	22	30.2	1,800

DOVER CANAL NEAR GUNNISON, UTAH.

LOCATION.—About on line between secs. 23 and 24, T. 19 S., R. 1 W., half a mile below head of canal, 3½ miles west of Gunnison, Sanpete County.

RECORDS AVAILABLE.—April 21, 1914, to September 30, 1916; irrigation seasons only.

GAGE.—Stevens water-stage recorder on left bank, with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Earth section. Canal carries large quantities of silt and has very low grade. A submerged weir, 30 feet below gage, serves as control, but stage-discharge relation is at times affected by backwater from below the weir.

DIVERSIONS.—Probably above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation changed several times during seasons of 1915 and 1916 by manipulation of the flash boards below gage. Several poorly defined rating curves used. Operation of water-stage recorder satisfactory throughout irrigation season. Daily discharge ascertained by applying to rating table, either directly or by shifting-control method, the mean daily gage height determined by inspecting recorder graph. Records fair.

Canal diverts water from left bank of Sevier River in the SW. ¼ sec. 24, T. 19 S., R. 1 W., about 1½ miles above confluence of San Pitch and Sevier Rivers. Water used for irrigation.

Discharge measurements of Dover canal near Gunnison, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 22	J. C. Dort	5.09	18.8	April 6	E. A. Porter	5.00	20.2
May 7	do	5.66	28.2	24	do	5.51	19.3
June 2	do	6.09	41.2	May 11	do	6.14	54.2
12	do	5.74	44.4	27	do	5.79	32.3
17	do	5.52	33.4	June 3	do	5.46	40.8
26	do	5.65	36.4	26	do	5.60	36.3
July 6	do	5.60	27.8	July 2	J. W. Thurston	5.70	35.5
9	Porter and Dort	6.18	27.4	15	E. A. Porter	5.78	45.9
17	J. C. Dort	6.13	23.9	19	Sanford and Porter	5.46	34.0
29	do	5.52	21.7	22	E. A. Porter	5.35	27.2
Aug. 2	do	5.94	32.0	Aug. 7	J. W. Thurston	5.38	29.2
31	do	5.93	21.4	18	E. A. Porter	5.43	30.2
Sept. 16	do	5.46	22.0	Sept. 8	do	5.38	27.3
Oct. 5	L. W. Jordan	5.32	20.8	18	Sanford and Porter	5.74	39.7
				26	E. A. Porter	5.68	38.1

Daily discharge, in second-feet, of Dover canal near Gunnison, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	3.7	22	41	38	27	22	27
2	....	2.9	23	42	37	28	24	26
3	0.6	2.9	24	....	36	19	20	17
4	.2	4.5	25	....	34	20	21	16
5	.6	9.0	26	....	34	15	15	21
6	.2	10	28	....	29	10	12	....
7	.0	10	28	....	25	8	10	....
8	.0	10	30	....	21	8	10	....
9	.0	9	28	....	26	9	20	....
10	.0	9	31	....	24	19	24	....
11	5.0	12	30	....	23	20	24	....
12	7.8	16	32	46	22	20	34	....
13	4.5	16	35	47	22	17	29	....
14	3.7	14	38	43	22	12	21	....
15	3.7	16	38	44	22	16	21	....
16	3.7	26	36	40	23	17	22	....
17	3.7	28	42	37	25	16	25	....
18	6.5	24	42	40	26	15	33	....
19	12	26	35	38	25	13	32	....
20	12	24	40	34	28	17	29	....
21	12	24	....	34	31	20	26	....
22	12	22	....	38	33	19	24	....
23	12	21	....	37	34	20	22	....
24	10	22	....	36	21	24	20	....
25	10	21	....	38	20	26	20	....
26	10	21	....	37	14	20	22	....
27	9	21	....	36	15	15	24	....
28	5.6	21	....	35	26	22	28	....
29	.0	20	....	37	23	20	29	....
30	.0	21	....	39	25	21	27	....
31	2.0	....	....	....	26	21	....	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	31	21	43	40	34	16	......	43	50	28	23	40
2	......	37	28	40	44	33	17	......	45	50	34	27	39
3	......	48	42	43	50	34	18	......	49	50	36	27	34
4	......	50	52	42	36	34	19	......	44	38	32	26	27
5	......	49	62	41	32	33	20	......	54	29	33	27	29
6	......	51	65	40	24	33	21	......	57	36	31	26	24
7	......	48	64	43	32	30	22	......	46	40	26	26	11
8	......	48	58	47	38	29	23	......	49	42	28	31	20
9	......	56	49	15	44	29	24	......	47	40	22	35	34
10	......	62	40	0	40	37	25	30	46	35	34	28	38
11	......	54	42	0	51	31	26	33	39	36	48	31	38
12	......	53	35	11	31	31	27	31	34	32	40	34	38
13	......	53	36	43	23	36	28	37	34	32	41	38	37
14	......	48	50	43	15	36	29	43	37	30	38	34	29
15	......	44	55	41	20	38	30	35	42	34	35	32	34
							31	......	27	......	40	33	......

NOTE.—1915: Unreliable gage-height record, discharge estimated, May 21–31, 41 sec.-ft.; June 3–11, 44, sec.-ft. 1916: No gage-height record, discharge estimated, Apr. 1–24, 30 sec.-ft., July 12–14, as given in table.

Monthly discharge of Dover canal near Gunnison, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
March 3-31	12	0	5.06	291
April	28	2.9	16.2	964
May	42	22	35.0	2,150
June	47	34	40.5	2,410
July	38	14	26.1	1,600
August	28	8	17.9	1,100
September	34	10	23.0	1,370
October 1-5	27	16	21.4	212
1916.				
April	....	....	[a] 31.0	1,840
May	62	27	46.0	2,830
June	65	21	42.4	2,520
July	48	0	33.5	2,060
August	51	15	32.2	1,980
September	40	11	32.3	1,920

[a] Estimated.

SAN PITCH RIVER NEAR GUNNISON, UTAH.

Location.—In NW. ¼ SW. ¼ sec. 13, T. 19 S., R. 1 W., about one-fifth of a mile below a small diversion dam, half a mile above confluence with Sevier River, and 3 miles west of Gunnison, Sanpete County.

Drainage area.—886 square miles (measured on topographic maps).

Records available.—February 21, 1912, to September 30, 1916. June 30, 1900, to December 31, 1905, at a point about 4 miles northeast of Gunnison.

Gage.—Stevens continuous water-stage recorder on right bank, at new datum, May 18, 1914, to September 30, 1916; vertical staff on left bank about one-fifth mile below small diversion dam, February 21, 1912, to May 17, 1914.

Discharge measurements.—Made from cable about 10 feet below gage, from bridge just below gage, or by wading.

Channel and control.—Bed composed of sand and gravel; shifting; right bank is high but left is low and subject to overflow.

Extremes of discharge.—Not determined.

Ice.—Stage-discharge relation seriously affected by ice. Observations discontinued temporarily during December, January and February.

Diversions.—In years of normal flow practically all the water of this stream is used for irrigation in the San Pete Valley and in the vicinity of Gunnison. Winter and spring run-off is stored in the Gunnison reservoir, about 7 miles above Gunnison. At times part of the water flowing past the gage is waste from the Kearns-Robbins (Fayette) canal (diverting from Sevier River), which crosses the San Pitch about half a mile above the gage.

Regulation.—Flow controlled by Gunnison reservoir. See "Diversions."

Accuracy.—Stage-discharge relation changed during winter. Rating curves fairly well defined by frequent measurements. Operation of water-stage recorder satisfactory, except as noted in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records for irrigation season good.

Discharge measurements of San Pitch River near Gunnison, Utah, for the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	L. W. Jordan	1.40	2.8	Mar. 17	E. A. Porter	3.61	448
Nov. 4	J. J. Sanford	1.36	2.3	19	.....do	2.32	94
22	L. W. Jordan	1.34	1.4	Apr. 3	.....do	2.66	216
Dec. 15	A. B. Purton	1.85	21.2	7	.....do	2.10	62
Jan. 5	.....do	[a] 2.82	12.9	14	.....do	1.31	3
Feb. 2	J. J. Sanford	[a] 2.26	1.9	18	J. J. Sanford	1.82	30.5
16	.....do	2.02	21.1	Sept 26	E. A. Porter	1.04	0.0

[a] Complete ice cover above, at, and below gage.

Daily discharge, in second-feet, of San Pitch River near Gunnison, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	Day.	Oct.	Nov.	Dec.	Apr.	May.	June.
1	2	8	......	192	3	1	16	5	2	22	11	14	4
2	2	7	......	192	3	2	17	4	2	25	16	15	2
3	2	3	......	192	3	3	18	4	2	30	21	15	1
4	3	2	2	126	3	3	19	4	2	38	14	17	......
5	3	2	......	117	3	4	20	4	2	22	14	16	......
6	3	2	......	69	3	4	21	4	2	12	14	12	......
7	3	3	......	60	4	4	22	6	2	15	6	15	......
8	3	2	......	58	5	4	23	6	2	12	4	21	......
9	4	2	......	44	6	4	24	11	2	6	3	18	......
10	4	2	......	36	7	4	25	16	3	......	3	15	......
11	4	2	......	28	8	4	26	14	2	......	3	12	......
12	4	2	......	20	9	4	27	10	2	......	3	8	......
13	8	2	......	12	10	4	28	10	3	......	3	4	......
14	5	3	......	3	11	4	29	9	3	......	3	3	......
15	5	3	22	6	13	4	30	8	2	......	3	2	......
							31	8	......	......	......	1	......

NOTE.—Stream dry June 19 to Sept. 30. Gage not operating Dec. 1-3, 5-14, 25-31., Jan. 1 to Mar. 31. Discharge interpolated for following dates when gage was not operating: Apr. 1-2, 10-13, 16-17, 23, 25-28, 30, May 1-5, 7-12, 24-27, 29-31, and June 2, 17, and 18.

Monthly discharge of San Pitch River near Gunnison, Utah, for the year ending Sept. 30 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	16	2	5.7	350
November	8	2	2.6	155
December	....	....	[a] 9.0	550
April	192	3	43	2,560
May	17	1	9.0	550
June	4	0	2.0	120

[a] Estimated.

WELLINGTON CANAL NEAR MILLS, UTAH.

LOCATION.—In SE. ¼ sec. 3, T. 16 S., R. 2 W., 300 feet below wasteway, 2 miles below canal heading, and 4 miles north of Mills post office, Juab County.

RECORDS AVAILABLE.—June 1, 1914, to September 30, 1916; irrigation seasons only; miscellaneous measurements in 1913.

GAGE.—Stevens water-stage recorder, with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 250 feet above gage.

CHANNEL AND CONTROL.—Bed composed of fine gravel and sand. Growth of moss and weeds causes backwater at gage during part of irrigation season.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation subject to frequent changes due to backwater from growth of moss below station and to flat gradient of canal. Rating curves poorly defined. Water-stage recorder not in operation at times, as clock stopped. Daily discharge ascertained by applying to rating table, either directly or by shifting-control method, the mean daily gage height determined by inspecting recorder graph. Discharge estimated for periods of defective gage-height record. Records poor.

Canal diverts water from left bank of Sevier River in the NE. ¼ sec. 15, T. 16 S., R. 2 W. Water is used for irrigation west of Sevier River near Mills.

Discharge measurements of Wellington canal near Mills, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
May 15	J. C. Dort	1.88	26.4	May 10	E. A. Porter	1.60	18.7
June 5	do	1.08	8.8	June 9	do	1.74	21.6
18	do	1.70	14.4	24	do	1.78	15.1
July 20	do	1.94	5.8	July 17	do	1.88	10.8
Aug. 11	do	1.76	9.5	Aug. 8	J. W. Thurston	1.91	12.2
Sept. 2	do	.99	4.8	13	R. H. Becknell	1.75	10.5
7	do	1.35	9.2	29	E. A. Porter	1.45	11.2
19	do	.69	3.1	Sept. 30	do	1.80	15.6
Oct. 7	L. W. Jordan	.60	[a] 0.8				

[a] Discharge estimated.

Daily discharge in second-feet, of Wellington canal near Mills, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1915.							1915.						
1	......	12	8	8	5	5	16	26	13	7	9	3	......
2	......	11	8	8	5	5	17	26	14	7	6	4	......
3	......	11	6	8	6	4	18	26	14	7	6	4	......
4	......	11	6	8	5	4	19	26	11	5	7	3	......
5	......	9	6	8	4	4	20	26	9	6	7	2	......
6	......	8	5	8	4	2	21	23	11	6	6	11	......
7	......	7	4	9	7	1	22	21	15	6	6	11	......
8	......	9	6	9	10	......	23	20	14	6	6	11	......
9	......	9	7	9	9	......	24	20	10	6	6	12	......
10	......	10	8	9	9	......	25	17	11	6	6	12	......
11	......	10	8	9	6	......	26	14	9	6	5	13	......
12	......	8	8	11	5	......	27	13	8	6	5	14	......
13	16	10	8	11	4	......	28	13	8	6	5	10	......
14	26	13	7	11	4	......	29	13	8	6	5	6	......
15	26	13	7	10	3	......	30	13	8	6	5	5	......
							31	10	......	4	5	......	......

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1916.						1916.					
1	24	0	14	2	11	16	16	21	12	11	14
2	24	0	13	2	10	17	14	22	11	12	15
3	24	10	13	2	10	18	14	23	11	14	15
4	24	20	15	3	10	19	14	17	10	13	16
5	24	20	13	0	10	20	14	16	9	14	16
6	24	22	13	0	10	21	14	16	7	16	16
7	24	23	13	5	10	22	14	16	6	14	16
8	24	23	13	11	10	23	12	16	6	10	16
9	24	22	13	6	10	24	10	15	6	17	16
10	19	23	13	5	11	25	8	15	6	17	16
11	20	22	0	8	13	26	6	16	5	16	16
12	20	22	0	10	12	27	4	14	2	16	16
13	19	21	0	11	13	28	0	10	1	13	16
14	16	20	10	11	13	29	0	13	1	11	16
15	16	20	12	11	14	30	0	14	1	11	16
						31	......	......	1	11	......

NOTE.—1915: Canal reported dry prior to May 12. No gage-height record, discharge estimated, May 13-14, 25, July 12-15.
1916: No gage-height record, discharge estimated, May 1-9, 23-27, July 5-16, Sept. 13-19, 21-30.

Monthly discharge of Wellington canal near Mills, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
1915.			1916.		
May 13-31	19.7	744	May	15.0	920
June	10.5	625	June	17.1	1,020
July	6.39	393	July	8.1	500
August	7.45	458	August	9.8	600
September	6.90	411	September	13.4	800
October 1-7	3.57	50			

SEVIER RIVER LAND & WATER CO.'S CANAL NEAR LEAMINGTON, UTAH.

Location.—In sec. 28, T. 14 S., R. 3 W., 200 feet below head of canal, half a mile above old Parley siding on the Los Angeles & Salt Lake Railroad, and about 7 miles northeast of Leamington, Millard County.

Records available.—April 21, 1914, to September 30, 1916.

Gage.—Stevens water-stage recorder on left bank, 100 feet above second tunnel, with inside and outside staff gages.

Discharge measurements.—Made from footbridge 400 feet above gage or by wading.

Channel and control.—Bed composed of gravel and clay. Sill of tunnel serves as control.

Ice.—Canal freezes over during the winter when water is usually being diverted for storage in Fool Creek reservoir.

Diversions.—None above station from this canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage discharge changed several times during 1915, and once during 1916. Rating curves well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table, either directly or by shifting-control method, the mean daily gage height determined by inspecting recorder graph, except for days of considerable variation, for which the means of hourly discharge were used. Records for irrigation seasons excellent; those for rest of period good.

Canal diverts water from left bank of Sevier River just below reservoir, in the SE. ¼ sec. 28, T. 14 S., R. 3 W. Water is used for irrigation and for storage in Fool Creek reservoir.

Discharge measurements of Sevier River Land & Water Co.'s canal near Leamington, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*	1915.		*Feet.*	*Sec.-ft.*
Oct. 10	R. W. Davenport	3.19	90	Nov. 29	L. W. Jordan	0.70	14.6
Nov. 19	J. J. Sanford	.30	7.1	Dec. 11	.....do	— .14	0.4
1915.				1916.			
Feb. 8	Lynn Crandall	[a] 1.62	4.9	Feb. 16	.....do	1.60	33.9
Mar. 14	L. W. Jordan	1.12	22.9	Mar. 29	E. A. Porter	3.12	87
Apr. 28	J. C. Dort	3.08	90	Apr. 11	.....do	3.62	100
May 16	.....do	2.80	74	May 2	.....do	3.16	88
17	.....do	1.28	27.1	17	.....do	.47	9.0
June 6	.....do	2.68	72	29	.....do	3.30	94
21	J. W. Thurston	3.52	106	June 28	Cottrell and Jacob	3.60	108
July 12	.....do	3.51	103	29	E. A. Porter	2.82	78
29	L. W. Jordan	2.70	67	July 22	E. A. Jacob	2.68	67
Aug. 19	Lynn Crandall	2.66	68	29	E. A. Porter	2.71	70
Sept. 5	J. C. Dort	1.19	26.9	Aug. 13	J. W. Thurston	3.38	103
Oct. 10	L. W. Jordan	1.78	39.9	30	Porter and Jacob	2.80	69
13	F. W. Cottrell	1.98	46.8	Sept. 25	E. A. Jacob	4.10	123
Nov. 4	.....do	2.65	70	25	F. W. Cottrell	4.11	122
4	.....do	1.15	24.0	27	E. A. Jacob	4.48	140

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Sevier River Land & Water Co.'s canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.										
1	86	90	....	26	49	90	77	106	68	34
2	79	90	....	25	51	87	64	104	68	35
3	88	90	4	25	45	86	64	104	27	42
4	90	90	4	25	40	80	64	103	....	38
5	90	79	5	26	42	76	68	103	....	27
6	90	87	5	25	55	74	71	103	....	27
7	90	87	5	26	60	71	70	104	19	27
8	90	87	5	25	59	70	71	103	68	28
9	90	87	10	25	52	71	73	97	69	29
10	90	87	....	24	54	71	77	105	68	30
11	90	87	....	24	55	71	79	105	68	30
12	90	87	....	24	58	71	80	99	68	29
13	90	80	....	24	62	72	81	93	68	29
14	90	80	....	24	62	72	82	93	68	28
15	90	72	....	16	62	75	83	93	67	26
16	90	56	....	....	62	73	79	92	67	26
17	90	40	....	....	62	45	83	92	66	26
18	90	17	....	....	64	28	92	92	67	26
19	90	8	....	....	65	28	98	92	67	26
20	90	6	....	....	70	40	93	91	67	34
21	90	6	....	....	72	49	103	84	67	38
22	90	7	....	....	73	48	111	81	62	45
23	90	4	26	....	75	48	121	75	57	45
24	90	3	26	....	80	47	120	69	52	46
25	90	....	26	....	95	47	114	69	38	47
26	90	....	26	....	98	48	111	68	37	47
27	90	....	27	....	92	54	110	69	36	48
28	90	....	26	....	90	53	108	68	36	50
29	90	....	....	....	89	57	107	68	36	51
30	90	....	....	....	90	74	107	68	36	51
31	90	....	....	27	....	80	....	68	35	....

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.											
1	53	23	14	2	39	95	91	99	79	70	63
2	53	23	12	2	39	99	87	99	79	70	60
3	60	23	3.4	2	38	103	83	103	79	72	60
4	77	28	2.3	2	37	103	83	103	79	72	60
5	77	23	2.0	13	40	99	83	99	83	74	60
6	74	21	2.0	21	44	99	83	91	81	74	60
7	52	20	1.7	23	42	95	83	87	81	77	58
8	35	20	1.4	23	25	103	83	81	79	81	60
9	36	20	1.2	28	4	107	83	87	74	87	72
10	41	20	.9	34	3	107	83	99	75	91	86
11	45	20	.6	35	26	107	95	103	81	95	86
12	46	20	.6	34	48	107	99	99	77	99	94
13	37	18	22	33	47	79	86	83	70	99	106
14	25	16	46	33	42	36	5	83	72	99	108
15	25	16	46	34	41	119	4	79	70	99	108
16	23	16	43	36	41	123	5	77	70	98	108
17	22	15	31	37	41	115	9	79	70	98	108
18	22	15	18	38	46	115	11	81	70	97	110
19	22	16	11	41	50	127	43	81	70	91	110
20	22	16	4.2	46	53	127	70	79	70	91	110
21	22	15	3.5	46	54	131	66	79	70	90	110
22	22	15	2.8	46	56	127	74	79	68	90	110
23	23	15	2.4	46	56	115	91	79	72	89	112
24	23	15	2.0	43	52	115	95	77	79	89	120
25	23	14	1.7	40	56	119	99	79	79	88	122
26	23	14	1.7	38	58	123	95	77	77	88	120
27	23	14	2	38	83	111	95	75	75	92	128
28	23	14	2	40	87	95	95	77	70	84	138
29	23	14	2	40	87	91	95	77	72	72	135
30	22	14	2	....	91	91	95	79	70	69	126
31	22	....	2	....	91	....	99	....	70	63	....

NOTE.—Gage out of commission Dec. 7-10, Feb. 2-4, Mar. 11 and 18; discharges interpolated.

NOTE.—1914-15: Canal reported dry Nov. 25 to Dec. 25, Jan. 6 to Feb. 2, Mar. 16-30, Aug. 4-6. Canal frozen, discharge estimated, Dec. 26 to Jan. 5, 10 second-feet; Feb. 3-9, as given in table; and Feb. 10-22, 22 second-feet. Clock stopped Nov. 7-12; discharge estimated from recorded change of stage. Shifting-control method used Apr. 29-30, July 21-23. Hourly discharge determined Nov. 5, Mar. 15, 31, May 16, 17, 20, 29, 30, June 1, 5, 20, 22, July 9, Aug. 3, 7, 22, 24, Sept. 2, 4, 20. 1915-16: No gage-height record, discharge interpolated, Dec. 7-10 Feb. 2-4, Mar. 11, 18. Discharge estimated Jan. 1-31, 2 second-feet. Shifting-control method used Aug. 16-25. Hourly discharge determined Oct. 3, 7, 13, 16, Nov. 4, Dec. 13, Feb. 5, Mar. 8, Apr. 14, May 13, 19.

Monthly discharge of Sevier River Land & Water Co.'s canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1914-15.				
October	90	79	89.5	5,500
November	90	0	47.6	2,830
December	....	....	1.9	117
January	....	....	1.6	98
February	27	0	17.2	955
March	26	0	12.6	775
April	98	40	66.1	3,930
May	90	28	63.1	3,880
June	121	64	88.7	5,280
July	106	68	89.1	5,490
August	69	0	50.1	3,080
September	51	26	35.5	2,110
The year	121	0	47.0	34,000
1915-16.				
October	77	22	35.3	2,170
November	28	14	17.8	1,060
December	46	0.6	9.27	570
January	....	....	2.00	123
February	46	2.0	30.8	1,770
March	91	3.0	48.9	3,010
April	131	36	106	6,310
May	99	4.0	73.2	4,500
June	103	75	85.7	5,100
July	83	68	74.5	4,580
August	90	63	85.4	5,250
September	138	58	96.9	5,770
The year	138	....	60.3	40,200

McINTYRE CANAL NEAR LEAMINGTON, UTAH.

LOCATION.—In NW. ¼ sec. 32, T. 14 S., R. 3 W., 400 feet below canal intake and about 6 miles northeast of Leamington, Millard County.

RECORDS AVAILABLE.—May 5, 1914, to September 30, 1916, irrigation seasons only; miscellaneous measurements in 1913.

GAGE.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Moss and weeds grow in canal during the irrigation season.

DIVERSIONS.—Above all diversions from canal.

REGULATION.—Flow controlled by head gates.

ACCURACY.—Stage-discharge relation not permanent. Measuring section poor on account of flat gradient and vegetation. Rating curves poorly defined. Operation of water-stage recorder satisfactory.

Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph; for days of considerable variation the means of hourly discharge were used.

Canal diverts water from right bank of Sevier River in the SE. ¼ sec. 29, T. 14 S., R. 3 W. Water used for irrigation west of the river near Leamington.

Discharge measurements of McIntyre canal near Leamington, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 28	J. C. Dort	1.70	21.7	May 2	E. A. Porter	1.57	21.9
May 16	.....do	1.58	17.0	17	.....do	1.82	25.4
June 6	.....do	1.62	18.4	29	.....do	1.53	18.3
21	J. W. Thurston	1.80	22.0	June 29	.....do	2.04	25.4
July 12	.....do	1.52	14.9	July 22	Johnson and Jacob	2.00	23.0
28	L. W. Jordan	1.74	19.4	29	E. A. Porter	1.54	16.7
Aug. 19	Lynn Crandall	1.66	18.8	Aug. 13	J. W. Thurston	1.86	23.7
Sept. 5	J. C. Dort	1.56	16.0	25	.....do	1.92	22.0
Oct. 10	L. W. Jordan	.80	2.5	30	Jacob and Porter	1.71	19.9
13	F. W. Cottrell	1.18	5.4				

Daily discharge, in second-feet, of McIntyre canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.							
1	......	15	10	19	20	19	13
2	......	18	15	19	20	17	13
3	......	20	19	19	20	18	12
4	......	19	19	19	20	18	7
5	......	19	19	19	20	17	3
6	......	19	18	19	20	17	4
7	......	18	18	19	20	16	4
8	......	18	18	18	20	18	3
9	7.7	18	18	18	19	18	3
10	7.5	18	19	18	19	20	3
11	7.3	19	19	18	18	20	......
12	7.9	22	18	16	18	19	......
13	9.0	22	18	16	18	19	......
14	11	22	18	16	18	18	......
15	11	20	17	16	17	14	......
16	11	18	17	18	12	11	......
17	14	16	10	18	5.2	12	......
18	18	16	0.4	18	16	12	......
19	19	15	0.9	14	19	11	......
20	20	15	13	6.2	19	8.0	......
21	22	18	22	16	19	7.1	......
22	22	20	23	21	19	18	......
23	23	19	23	20	20	20	......
24	22	19	21	20	19	19	......
25	24	19	20	19	18	16	......
26	23	18	20	20	15	16	......
27	22	18	20	21	15	17	......
28	22	18	20	20	18	18	......
29	23	18	19	20	20	18	......
30	21	16	19	20	20	15	......
31	......	13	......	20	19	......	......

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	22	22	24	23	21	16	16	22	21	22	0	22
2	......	22	23	24	23	21	17	17	22	22	21	0	21
3	......	22	23	24	23	20	18	17	21	22	19	15	21
4	......	22	23	24	22	20	19	17	20	22	18	24	21
5	......	23	24	25	23	20	20	16	19	14	20	24	21
6	......	23	24	26	23	20	21	16	18	0	24	24	21
7	......	23	24	26	23	19	22	16	19	7	24	24	21
8	......	23	24	26	22	20	23	19	21	22	24	24	21
9	......	23	24	26	22	21	24	21	20	23	23	23	21
10	......	24	24	25	20	21	25	21	19	23	23	23	21
11	......	24	23	25	20	21	26	22	18	23	23	23	21
12	......	24	20	26	22	21	27	22	18	23	22	22	20
13	......	23	20	26	22	21	28	23	18	21	20	22	21
14	8	23	21	25	22	22	29	22	19	23	19	21	20
15	15	22	21	23	15	22	30	22	21	24	16	21	19
							31	......	21	......	20	21	......

Monthly discharge of McIntyre canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
April 9-30	24	7.3	16.7	729
May	22	13.0	18.2	1,120
June	23	.4	17.0	1,010
July	21	6.2	18.1	1,110
August	20	5.2	18.1	1,110
September	20	7.1	16.2	964
October 1-10	13	2.6	6.5	129
1916.				
April 14-30	23	0	10.0	595
May	24	18	21.3	1,310
June	24	0	21.0	1,250
July	26	16	23.0	1,410
August	24	0	20.5	1,260
September	22	19	20.7	1,230

LEAMINGTON CANAL NEAR LEAMINGTON, UTAH.

Location.—In SW. ¼ sec. 32, T. 14 S., R. 3 W., 200 feet below head of canal and 6 miles northeast of Leamington, Millard County.

Records available.—April 20, 1914, to September 30, 1916; irrigation seasons only; miscellaneous measurements in 1913.

Gage.—Stevens water-stage recorder on right bank, with inside and outside staff gages.

Discharge measurements.—Made by wading or from footbridge 150 feet below gage.

Channel and control.—Bed composed of gravel. Concrete wall about 6 feet below gage serves as control, but gravel fills in at times between gage and control, causing changes in stage-discharge relation. Growth of moss in canal below control causes backwater at times, except for low stages.

Diversions.—Above all diversions from canal.

Regulation.—Flow controlled by head gates.

Accuracy.—Stage-discharge relation permanent except for periods in summer when heavy moss growth produced backwater over control at stages exceeding 2 feet. Two fairly well defined rating curves used for season of 1915, one well defined curve for 1916. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph; shifting-control method used for period April 28 to May 15, 1915. Records good.

Canal diverts water from left bank of Sevier River, in the SW. ¼ sec. 32, T. 14 S., R. 3 W. Water is used for irrigation near Leamington, east of river.

Discharge measurements of Leamington canal near Leamington, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Apr. 27	J. C. Dort	2.20	46.0	Mar. 29	E. A. Porter	1.26	2.5
May 16	.....do	2.02	26.5	Apr. 11	.....do	1.62	13.5
June 6	.....do	1.54	9.1	May 2	.....do	2.02	43.6
21	J. W. Thurston	1.30	3.4	17	.....do	1.95	37.8
July 12	.....do	1.76	22.0	29	.....do	1.79	23.7
28	L. W. Jordan	1.82	24.0	June 30	.....do	1.63	16.7
Aug. 19	Lynn Crandall	1.34	3.8	July 29	.....do	1.65	15.7
19	.....do	1.76	21.3	Aug. 30	Jacob and Porter	1.72	20.4
Sept. 5	J. C. Dort	1.55	10.3				
Oct. 10	L. W. Jordan	1.40	6.0				

Daily discharge, in second-feet, of Leamington canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1915.								
1	....	0.1	38	13	16	24	13	22
2	....	.1	37	14	16	24	11	20
3	....	.1	36	14	16	24	13	20
4	....	.1	33	14	16	24	13	20
5	....	.1	31	12	16	22	11	16
6	....	.2	29	10	16	18	10	11
7	....	.2	28	10	17	18	11	7
8	....	.2	28	11	22	18	15	5
9	....	.2	29	12	20	18	20	5
10	....	.2	28	14	20	19	21	6
11	....	.2	28	16	21	20	16	....
12	....	.4	27	17	22	20	16	....
13	....	.5	26	19	22	21	16	....
14	0.1	.8	26	19	23	22	14	....
15	.1	4	27	20	24	22	8	....
16	.1	4	27	22	24	23	7	....
17	.1	8	28	19	24	23	8	....
18	.1	14	28	5	24	19	8	....
19	.1	18	28	5	25	8	7	....
20	.1	25	29	4	25	22	5	....
21	.1	32	25	4	25	24	3	....
22	.1	33	19	6	25	24	9	....
23	.1	34	10	8	24	24	13	....
24	.1	33	5	16	24	23	14	....
25	.1	48	5	24	24	20	16	....
26	.1	51	5	19	24	18	16	....
27	.1	48	5	16	24	16	18	....
28	.1	45	5	16	24	16	20	....
29	.1	41	11	16	24	16	22	....
30	.1	39	14	16	24	16	22	....
31	.1	....	14	....	24	14	....	....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1916.							1916.						
1	......	47	28	17	20	21	16	12	40	21	35	23	21
2	......	45	28	20	21	21	17	12	38	21	36	23	21
3	......	44	28	20	23	21	18	11	36	21	38	23	21
4	......	43	28	21	24	21	19	12	32	21	37	23	21
5	......	42	29	23	28	20	20	28	29	20	32	23	20
6	......	43	30	23	28	20	21	38	27	20	28	24	20
7	......	43	30	22	26	20	22	35	26	20	27	24	20
8	......	42	30	22	20	23	23	13	26	19	26	24	21
9	10	41	30	21	16	24	24	6	27	19	26	23	23
10	15	40	30	22	19	23	25	6	26	17	25	23	26
11	15	40	28	21	23	23	26	20	26	18	21	23	26
12	15	38	28	23	28	23	27	45	26	18	20	22	22
13	14	39	28	30	29	22	28	45	25	16	15	22	22
14	14	43	27	30	28	21	29	45	25	15	17	23	20
15	14	42	21	30	23	21	30	50	25	16	19	20	19
							31	......	27	......	22	21	......

Monthly discharge of Leamington canal near Leamington, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
March 14-31	0.1	0.1	0.10	4
April	51.0	.1	16.0	952
May	38.0	4.6	22.8	1,400
June	24.0	3.6	13.6	809
July	25.0	16.0	21.8	1,340
August	24.0	8.0	20.0	1,230
September	22.0	3.0	13.2	786
October 1-10	22.0	5.2	13.2	262
1916.				
April 9-30	50	0	15.8	940
May	47	25	35.3	2,170
June	30	15	23.5	1,400
July	38	15	24.8	1,520
August	29	16	23.2	1,430
September	26	19	21.6	1,290

CANAL A NEAR DELTA, UTAH.

LOCATION.—In SE. ¼ sec. 26, T. 16 S., R. 6 W., about a quarter of a mile below head gates and 8 miles northeast of Delta, Millard County.

RECORDS AVAILABLE.—April 14, 1912, to September 30, 1916; irrigation seasons only.

GAGE.—Gurley printing water-stage recorder on right bank one-fourth mile below head gates since March 14, 1913; inclined staff gage at same site and datum, April 14, 1912, to March 14, 1913.

DISCHARGE MEASUREMENTS.—Made from cable about 80 feet below gage.

CHANNEL AND CONTROL.—Uniform earth section. No well-defined control. Stage-discharge relation probably affected by growth of moss and weeds farther down canal and by silt collecting in the channel.

DIVERSIONS.—No diversions between head gates and gage. About 6 miles below the canal divides into canal B and canal C.

REGULATION.—Flow regulated at the head gates.

ACCURACY.—Stage-discharge relation fairly permanent; affected during summer by moss growing in canal below gage.

Several well-defined rating curves used. Mean daily gage height determined by averaging gage heights printed every 15 minutes by water-stage recorder. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying mean daily gage-height to rating tables; shifting-control method used July 12–21 and Sept. 1–3, 1916. Records good.

COOPERATION.—Gage-height records furnished and many discharge measurements made by lower Sevier River Water Commissioner.

Canal diverts water from Sevier River in the SE. ¼ sec. 26, T. 16 S., R. 6 W., and is used jointly by the Delta Land & Water Co., and by the Melville Irrigation Co. About 6 miles below gage the canal divides into canal B, which serves the north side tract of the Delta Land & Water Co., and canal C, which serves the Melville Irrigation Co. Canal C will be enlarged to serve the south tract of the Delta Land & Water Co. Waste waters only are returned to the river.

Discharge measurements of canal A near Delta, Utah, during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
1914.				1915.			
Nov. 21	J. J. Sanford	1.91	59	Nov. 18	J. C. Dort	2.44	100
				28	.....do	1.85	49.4
1915.							
Apr. 30	Dort and Cottrell	4.54	396	1916.			
June 9	J. C. Dort	2.58	111	Mar. 25	E. A. Porter	0.97	1.0
28	F. W. Cottrell	4.47	352	Apr. 9	.....do	1.69	47.8
July 1	J. W. Thurston	3.76	256	27	.....do	4.92	443
21	J. C. Dort	3.25	186	May 8	.....do	5.40	508
Aug. 4	F. W. Cottrell	3.50	220	9	.....do	5.24	475
20	Lynn Crandall	3.50	202	22	.....do	3.75	256
24	F. W. Cottrell	3.62	235	June 8	.....do	3.58	235
26	.....do	2.00	64	July 10	J. W. Thurston	3.33	210
Sept. 4	Dort and Cottrell	1.35	15.7	31	E. A. Porter	2.66	98
Oct. 9	L. W. Jordan	2.67	115	Aug. 2	J. W. Thurston	1.63	37.3
18	F. W. Cottrell	3.00	151	19	E. A. Porter	3.53	215
28	.....do	3.87	264	31	Jacob and Porter	3.32	184
Nov. 5	J. C. Dort	3.14	168	Sept. 4	E. A. Porter	2.78	135
11	F. W. Cottrell	3.66	239	21	.....do	3.19	185
12	J. C. Dort	3.65	231				

Daily discharge, in second-feet, of canal A near Delta, Utah, for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.									
1	288	232	11	19	352	70	274	199	59
2	281	220	8	19	366	86	267	207	55
3	274	216	7	17	359	100	281	218	52
4	281	223	6	15	352	96	274	222	30
5	274	212	4	25	336	82	260	227	33
6	274	210	4	25	322	66	212	232	35
7	274	220	4	39	322	73	176	229	32
8	274	228	4	37	344	83	164	229	32
9	253	238	4	15	352	102	154	238	32
10	239	252	4	19	366	116	154	245	40
11	253	232	4	24	390	145	182	243	56
12	253	216	4	30	406	182	212	240	111
13	227	192	4	46	414	219	232	235	133
14	232	180	....	90	422	253	232	235	121
15	233	186	....	124	430	212	226	228	105
16	229	180	....	135	422	194	212	227	118
17	222	172	....	139	422	246	206	233	134
18	216	126	....	140	438	309	200	227	135
19	227	80	....	165	406	351	194	215	133
20	254	61	....	198	314	366	188	215	135
21	273	57	....	233	177	366	176	235	138
22	232	58	....	262	170	388	169	242	138
23	242	58	....	284	131	410	171	245	139
24	275	52	....	306	133	410	163	243	146
25	267	36	....	314	97	396	156	126	147
26	257	25	....	314	86	390	156	65	136
27	257	23	....	329	60	366	149	80	126
28	254	21	....	359	43	351	156	68	131
29	250	18	....	390	42	337	164	60	152
30	249	14	....	374	39	309	180	70	170
31	252	....	....	....	48	....	195	71	....

Daily discharge, in second-feet, of canal A near Delta, Utah, for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	165	120	65	32	500	200	114	52	104
2	171	89	65	30	500	206	116	59	110
3	165	121	50	62	518	206	101	39	122
4	165	149	37	38	536	206	100	35	135
5	184	171	33	34	536	218	100	38	141
6	190	190	22	47	536	293	86	52	137
7	190	196	13	75	518	286	114	63	120
8	190	203	12	72	518	244	176	63	112
9	121	203	12	48	500	314	188	52	112
10	96	217	10	48	483	321	200	88	118
11	79	224	10	83	466	321	218	159	153
12	76	231	9	130	449	321	293	184	182
13	81	231	....	144	440	359	272	196	149
14	93	217	....	152	440	383	272	217	160
15	119	203	....	200	440	383	284	224	165
16	135	196	....	218	407	344	280	217	176
17	142	159	....	265	375	314	268	224	194
18	152	106	....	293	367	351	288	231	182
19	159	92	....	307	391	328	274	224	170
20	159	96	....	307	336	336	259	210	170
21	159	101	....	328	279	351	252	231	188
22	159	104	....	351	258	359	217	231	194
23	165	97	....	367	265	336	190	217	182
24	177	85	....	367	279	336	177	196	182
25	196	79	....	351	272	344	190	203	165
26	224	81	....	367	251	336	210	184	151
27	252	63	....	432	251	336	203	190	182
28	266	56	....	466	286	300	190	184	200
29	266	55	....	483	314	238	165	190	206
30	252	65	....	500	321	129	151	196	206
31	231	....	....	....	232	....	90	126	....

NOTE.—No flow Dec. 14, 1914, to Mar. 31, 1915, and Dec. 13, 1915, to Mar. 31, 1916.

Monthly discharge of canal A near Delta, Utah, for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1914–15.				
October	298	216	257	15,800
November	252	14	141	8,390
December	11	0	2.2	133
January	....	....	0	0
February	....	....	0	0
March	....	....	0	0
April	390	15	150	8,930
May	438	39	276	17,000
June	410	66	235	14,000
July	281	149	198	12,200
August	245	60	195	12,000
September	170	30	100	5,950
The year	....	....	....	94,400
1915–16.				
October	266	76	167	10,300
November	231	56	140	8,330
December 1-12	65	9	28	670
January	....	....	0	0
February	....	....	0	0
March	....	....	0	0
April	500	30	220	13,100
May	536	232	396	24,300
June	383	129	300	17,900
July	293	86	195	12,000
August	231	35	154	9,470
September	206	104	159	9,460

BEAVER RIVER BASIN.

BEAVER RIVER NEAR BEAVER, UTAH.

Location.—In SE. ¼ sec. 13, T. 29 S., R. 7 W., half a mile above city diversion dam at mouth of canyon, 3 miles above Beaver, Beaver County.

Drainage area.—82 square miles.

Records available.—June 15 to September 26, 1906; March 15, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank Novenber 14, 1914, to September 30, 1916; Lietz recorder March 30 to November 13, 1914. Datum of recording gages 0.03 foot lower than that of old vertical staff gage at same site, used prior to March 30, 1914. Gage inspected by G. W. Valentine.

Discharge measurements.—Made from footbridge 70 feet above gage or by wading.

Channel and control.—Bed composed of boulders and coarse gravel; fairly permanent. One channel; left bank is overflowed at extremely high stages.

Extremes of discharge.—Maximum stage recorded during year, 4.93 feet at 7 p. m. May 9 (discharge, 412 second-feet); minimum stage, 2.57 feet at 7 a. m. January 28 (discharge, 8 second-feet).

1914–1916: Maximum stage recorded, 5.48 feet, May 21, 1914 (discharge, 650 second-feet); minimum stage, 2.57 feet, January 28, 1916 (discharge, 8 second-feet).

Ice.—Stage-discharge relation seriously affected by ice at times.

Diversions.—Above all irrigation diversions. Above the station is a small storage reservoir known as Cants Lake. Water is diverted by the Beaver River Power Co., but returned to the river several miles above the station.

Regulation.—Flow probably not affected by operation of Beaver River Power Co. plant, but is affected by Cants Lake storage reservoir.

Accuracy.—Stage-discharge relation permanent except as affected by ice. Rating curve fairly well defined between 25 and 80 second-feet; poorly defined above. Operation of water-stage recorder satisfactory except for frequent breaks in record during October and November. Daily discharge ascertained by applying to rating table, the mean daily gage height determined by inspecting gage height graph. Discharge estimated for periods of broken record and ice effect, as noted in footnote to table of daily discharge. Records good.

Discharge measurements of Beaver River near Beaver, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14	L. W. Jordan	2.93	25.0	Mar. 28	C. C. Jacob	3.24	57
Jan. 12	E. A. Porter	[a] 3.27	16.7	May 23	A. B. Purton	4.12	208
Feb. 8	J. J. Sanford	2.87	22.9	July 31	A. M. Gilbert [b]	3.31	62
8	do	2.87	22.5				

[a] Stage-discharge relation affected by ice.
[b] Engineer for Beaver County Irrigation Co.

Daily discharge, in second-feet, of Beaver River near Beaver, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26		23			23	45	165	207	84	77	40
2	27		24			25	49	167	207	82	75	39
3			25			26	50	178	207	80	112	39
4			25			27	47	209	212	79	84	39
5			25		27	27	45	249	218	77	78	40
6		27	26		25	26	44	294	212	78	72	37
7			24		24	26	44	314	203	80	84	37
8			25		23	26	46	325	196	79	69	38
9	28		25		26	28	56	356	203	75	63	44
10			26		26	36	78	340	203	75	61	40
11			26		26	43	90	320	186	75	56	40
12			24	17	26	44	78	308	176	87	55	42
13		28	26		24	48	73	280	167	86	54	38
14		28	25		25	48	78	237	163	84	53	39
15		28	27		27	44	90	209	163	82	50	42
16	31	28	24		28	47	108	194	153	80	53	36
17	30	28			28	52	118	188	144	73	47	35
18	29	29			28	54	104	192	137	63	43	39
19		27			28	55	94	203	132	61	39	43
20		27			28	64	88	186	124	60	39	35
21		26			26	67	95	176	119	63	39	37
22		27			29	67	112	190	110	63	39	37
23	26	26			30	67	140	196	100	58	39	35
24	26	26			29	59	158	184	97	59	38	35
25	26	22			29	52	162	167	91	73	39	39
26		25			26	53	169	165	87	70	41	37
27		26			30	53	205	173	87	73	39	31
28		23			28	55	219	182	94	69	42	30
29		27			28	52	240	196	93	62	46	32
30	26	25				49	186	212	87	73	42	32
31	26					45		216		66	41	

NOTE.—Oct. 1 to Nov. 12, gage not operating satisfactorily; discharge estimated or interpolated as follows: Oct. 3–8, 27 second-feet; Oct. 10–15, 30 second-feet; Oct. 19–22, 28 second-feet; Oct. 26–29, 26 second-feet; Nov. 1–5, 26 second-feet; and Nov. 7–12, 27 second-feet. Mean flow estimated on account of ice as follows: Nov. 15–16, 28 second-feet; Dec. 17–31, 20 second-feet; Jan. 1–11, 17 second-feet; Jan. 13–31, 16 second-feet; and Feb. 1–4, 22 second-feet.

Monthly discharge of Beaver River near Beaver, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October			27.7	1,700
November			26.5	1,580
December			22.6	1,390
January			16.4	1,010
February	30		26.3	1,510
March	67	25	44.9	2,760
April	249	44	105	6,250
May	356	165	225	13,800
June	218	87	153	9,100
July	87	58	73.2	4,500
August	112	38	55.1	3,390
September	44	30	37.6	2,240
The year	356		67.8	49,200

BEAVER RIVER AT ADAMSVILLE, UTAH.

Location.—In S. ½ sec. 30, T. 29 S., R. 8 W., 100 yards below highway bridge on road from Milford to Beaver, a quarter of a mile above mouth of Indian Creek, and three-quarters of a mile south of Adamsville, Beaver County.

Drainage area.—272 square miles (measured on topographic maps).

Records available.—December 16, 1913, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank 5 feet below cable, March 13, 1914, to September 30, 1916; inspected by W. A. Rees. Friez water-stage recorder at same site December 16, 1913, to March 12, 1914.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of fine gravel. Permanent concrete control constructed July 11, 1916. Stage of zero flow, about 1.2 feet. Banks low; covered with willows; overflowed at extremely high stages.

Extremes of discharge.—Maximum stage recorded during year, 4 feet at 8 p. m. August 5 (discharge, 427 second-feet); minimum stage, 1.30 feet at 9 p. m. July 1 (discharge, 3 second-feet).

1914–1916: Maximum stage recorded, 4.26 feet at 5 a. m. June 3, 1914 (discharge, 544 second-feet); minimum stage, 1.30 feet at 9 p. m. July 1, 1916 (discharge, 3 second-feet).

Ice.—Stage-discharge relation seriously affected by ice for short periods.

Diversions.—No diversions between the station and the storage reservoir of the Beaver County Irrigation Co. There are a number of ditches above the station supplying the Adamsville and Beaver districts.

Regulation.—Low-water flow affected by irrigation diversions.

Accuracy.—Since July 11, 1916, stage-discharge relation permanent; previously subject to change. Rating curve well defined below 150 second-feet. Water-stage recorder operated satisfactorily throughout the year except during winter when station was icebound at times. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Several rating tables used for various periods previous to July; shifting-control method used for periods of change in rating. Records good for October, November, March, April, May, and June; excellent for July, August, and September· fair for December, January, and February.

Discharge measurements of Beaver River near Adamsville, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15	L. W. Jordan	1.96	51	June 12	A. M. Gilbert	1.86	48.4
Jan. 13	E. A. Porter	[a] 2.17	49.7	19	.....do	1.59	21.8
Feb. 9	J. J. Sanford	1.93	56	20	.....do	1.41	8.5
9	.....do	1.93	59	July 13	.....do	1.40	6.3
Mar. 28	Jacob and Gilbert	2.28	118	15	.....do	1.67	24.4
May 20	A. M. Gilbert [b]	2.27	132	16	.....do	1.71	27.3
23	A. B. Purton	2.11	93	26	.....do	1.88	45.6
30	A. M. Gilbert	1.81	47.9	Aug. 6	.....do	2.46	120
June 6	.....do	1.78	41.0				

[a] Stage-discharge relation affected by ice.
[b] Project manager Beaver County Irrigation Co.

Daily discharge, in second-feet, of Beaver River at Adamsville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	23	45	......	......	60	101	111	47	3.4	35	16
2	18	23	45	......	......	60	104	94	47	4.2	35	17
3	18	23	46	......	......	62	102	81	48	4.2	69	17
4	20	24	46	44	......	72	99	83	44	3.8	59	17
5	20	24	47	47	53	85	94	92	45	3.8	163	17
6	20	31	47	45	53	64	90	108	45	3.8	123	16
7	20	50	47	46	56	56	86	153	47	3.8	78	17
8	20	44	46	51	56	52	86	162	46	......	65	17
9	18	41	46	55	70	54	85	186	46	......	59	18
10	16	42	46	47	72	58	95	192	50	......	53	18
11	15	42	46	44	76	62	120	173	50	......	43	18
12	15	44	46	......	80	70	111	160	46	9.0	40	18
13	18	42	46	......	74	72	104	144	44	8.0	40	20
14	17	40	46	......	75	76	102	118	41	13	38	21
15	18	46	46	......	76	82	110	106	36	24	33	21
16	21	50	46	48	76	86	118	92	33	27	32	20
17	22	51	46	46	70	89	130	85	31	28	30	17
18	25	51	46	......	64	92	120	75	27	26	22	16
19	26	52	46	......	62	92	105	85	20	26	18	14
20	26	51	......	......	58	98	89	120	9.0	20	16	14
21	24	48	......	......	51	105	86	98	7.0	18	14	14
22	24	50		......	51	108	80	90	5.4	21	13	14
23	24	48	......	46	48	120	77	90	5.8	27	11	13
24	22	47	......	48	48	117	90	79	5.4	37	11	13
25	19	46	......	52	47	102	98	70	5.4	41	11	13
26	19	47	43	50	48	111	98	60	5.4	46	10	13
27	22	48	46	46	54	112	105	55	4.6	45	11	12
28	22	45	......	48	58	117	136	52	4.6	47	11	13
29	22	46	......	48	54	116	180	47	4.6	40	12	14
30	22	47	......	48	......	110	139	51	4.2	35	13	15
31	22	......	......	48	......	101	......	48	......	36	16	......

NOTE.—Mean discharge estimated, because of ice, as follows: Dec. 20–25, 43 second-feet; Dec. 28 to Jan. 3, 44 second-feet; Jan. 12–15, 46 second-feet; Jan. 18–22, 45 second-feet; Feb. 1–4, 50 second-feet. Mean discharge estimated while artificial control was being installed July 8–11, 5 second-feet.

Monthly discharge of Beaver River at Adamsville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	26	15	20.5	1,260
November	52	23	42.2	2,510
December	47	....	45.4	2,790
January	55	....	46.6	2,870
February	80	....	59.7	3,430
March	120	52	85.8	5,280
April	180	77	105	6,250
May	192	47	102	6,270
June	50	4.2	28.5	1,700
July	47	3.4	20.3	1,250
August	163	10	38.2	2,350
September	21	12	16.1	958
The year	192	3.4	50.8	36,900

BEAVER RIVER AT ROCKYFORD DAM, NEAR MINERSVILLE, UTAH.

Location.—In NW. ¼ sec. 11, T. 30 S., R. 9 W., half a mile below Rockyford dam and 4 miles above Minersville, Beaver County.

Drainage area.—512 square miles (measured on topographic maps).

Records available.—December 18, 1913, to September 30, 1916.

Gage.—Friez water-stage recorder on right bank, at present site June 1 to September 30, 1916; Friez water-stage recorder at former site 1,000 feet below dam December 18, 1913, to May 31, 1916; no determined relation between old and new datum. Between these two points inflow from springs amounted in June, 1916, to about 8 second-feet, varying with stage of water in reservoir. Observers, A. N. Stoddard and A. M. Gilbert.

Discharge measurements.—Made from cable near present gage or by wading.

Channel and control.—Bed composed of gravel; some vegetal growth. One channel at all stages. Banks not subject to overflow. Stage of zero flow, 0.6 foot. At upper site bed composed of rocks and boulders. Rocks embedded in concrete, 15 feet below gage, serve as control. One channel. Right bank high; left bank low. Stage of zero flow, about 1.9 feet.

Extremes of discharge.—Maximum stage recorded during year, 1.66 feet from 8 p. m. August 23 to 3 p. m. August 24, at lower site (discharge, 168 second-feet); minimum stage recorded, 1.88 feet, November 11–18, at upper site (discharge, 2 second-feet).

1913–1916: Maximum stage recorded, 5.37 feet, June 6, 1914 (discharge, 366 second-feet); minimum stage, 1.68 feet, March 19 and 20, 1914 (discharge estimated 0. 3 second-foot).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—None between dam and station.

Regulation.—Flow controlled by operation of gates at Rockyford dam.

Accuracy.—Stage-discharge relation at both sites permanent. Rating curves well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating tables the mean daily gage height determined by inspecting recorder graph. Records good.

Discharge measurements of Beaver River at Rockyford dam, near Minersville, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
-	**Upper site.**				**Lower site.**		
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15	L. W. Jordan	1.90	1.0	May 17	A. M. Gilbert [a]	1.30	97
Feb. 9	J. J. Sanford	2.36	[b] 7.2	21	do	1.13	72
May 23	A. B. Purton	3.55	72	June 5	do	1.46	132
				6	do	1.32	105
				25	do	1.51	137
				July 13	do	1.34	114
				26	do	0.72	31.3

[a] Project manager, Beaver County Irrigation Co.

[b] Discharge at lower station, 15.4 sec.-ft.

Daily discharge, in second-feet, of Beaver River at Rockyford dam near Minersville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	28	14	4	4	7	12	11	104	136	140	52	34
2	26	30	4	4	7	12	11	104	136	123	49	34
3	25	30	4	4	7	12	11	104	136	110	16	33
4	26	30	4	5	7	12	11	110	131	113	15	33
5	26	30	4	5	7	12	11	114	126	121	31	33
6	22	29	4	5	8	12	11	114	126	123	41	33
7	28	18	4	6	8	12	11	114	126	121	46	32
8	25	11	4	6	8	12	11	114	126	124	58	32
9	23	14	4	6	8	12	11	114	126	124	88	32
10	22	2	4	6	8	12	11	114	126	105	113	32
11	21	2	4	6	9	12	11	110	110	105	138	32
12	22	2	4	6	9	12	12	107	101	103	144	33
13	23	2	4	6	9	11	12	102	103	105	144	34
14	25	2	4	7	9	11	19	102	110	105	142	34
15	28	2	4	7	9	11	30	102	110	105	144	34
16	29	2	4	7	10	11	33	102	110	103	147	34
17	25	2	4	7	10	11	30	93	108	103	144	34
18	26	2	4	7	11	11	30	91	121	103	149	33
19	27	2	4	7	11	11	33	87	140	105	149	33
20	28	3	4	7	11	11	39	83	136	108	147	124
21	28	3	4	7	11	11	44	83	110	113	149	153
22	28	3	4	7	11	11	53	73	113	113	151	115
23	28	5	4	7	11	11	66	68	136	113	151	35
24	28	3	4	7	12	11	69	67	136	115	162	36
25	28	3	4	7	12	11	81	65	136	69	155	77
26	28	3	4	7	12	11	95	58	121	32	157	103
27	28	3	4	7	12	11	92	64	136	32	159	101
28	28	3	4	8	12	11	104	58	144	33	151	98
29	28	3	4	8	12	11	106	83	142	33	123	64
30	28	3	4	7	......	11	104	113	140	37	119	34
31	25	......	4	7	......	11	......	128	......	48	98	......

NOTE.—Daily discharge Oct. 1 to May 31 at upper site; June 1 to Sept. 30 at lower site. See station description. About 8 second-feet inflow between upper and lower sites.

Monthly discharge of Beaver River at Rockyford dam, near Minersville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	29	21	26.1	1,600
November	30	2	8.63	514
December	4	4	4.00	246
January	8	4	6.35	390
February	12	7	9.59	552
March	12	11	11.4	701
April	106	11	39.1	2,330
May	128	58	95.0	5,460
June	142	101	125	7,440
July	140	32	96.4	5,930
August	162	15	114	7,010
September	153	32	52.3	3,110

NOTE.—See footnote to table of daily discharge.

INDIAN CREEK AT ADAMSVILLE, UTAH.

LOCATION.—In sec. 30, T. 29 S., R. 8 W., at highway bridge just east of Adamsville, Beaver County, about three-quarters of a mile above confluence with Beaver River.

DRAINAGE AREA.—180 square miles (measured on topographic map).

RECORDS AVAILABLE.—June 26 to August 31, 1906; March 16, 1914, to September 30, 1916.

GAGE.—Vertical staff nailed to left bridge abutment; read by W. A. Rees.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of rocks, gravel, and sand. Rock control, semi-permanent. One channel at all stages. Banks high and not subject to overflow under ordinary conditions.

Extremes of discharge.—Maximum stage recorded during year, 6.2 feet at 3 p. m. August 5 (discharge, not estimated); minimum discharge, 0.1 second-foot, April 30 and September 15–19.

1914–1916: Maximum stage recorded, 6.3 feet during night of September 2, 1915 (discharge not determined); minimum stage, 1.70 feet March 24–28 and April 1–2, 1914 (no flow).

Ice.—Stage-discharge relation affected by ice at times.

Diversions.—Below all diversions. At certain seasons a small amount of seepage (probably not more than 1 or 2 second-feet) enters between gage and mouth of creek.

Regulation.—Flow affected by small storage reservoir and irrigation diversions above.

Accuracy.—Stage-discharge relation not permanent. Affected by ice at times, November 13 to February 7. Rating curves not well defined and only roughly approximate above 15 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating tables except for days of floods, when rough hourly discharge graphs were drawn and mean for the day was determined by inspection. Records poor.

Discharge measurements of Indian Creek at Adamsville, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14	L. W. Jordan	2.08	0.4	Feb. 9	J. J. Sanford	2.74	8.4
Jan. 13	E. A. Porter	([a])	.6	May 23	A. B. Purton	2.50	1.8

[a] Ice in stream and gage height of no value; flow estimated.

Daily discharge, in second-feet, of Indian Creek at Adamsville, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.3	0.5		1.9	10	1.5	0.2	0.3	52	0.4
2	1.0	.6		2.1	11	1.4	3	3	13	.4
3	8	.5		1.9	11	1.0	3	3	.7	1.2
4	.6	.6		1.9	14	.4	.3	.3	.6	1.0
5	.6	.6		2.1	14	.4	.3	.3	67	1.0
6	.6	1.3		1.9	12	.2	.4	.2	4.0	.7
7	.6	18		1.9	11	.2	.7	.5	.9	.7
8	1.0	2.0	22	1.9	8.9	.3	1.0	.5	.4	.3
9	1.0	2.2	18	2.2	10	.3	1.1	.4	.2	.4
10	1.0	3.0	22	3.0	8.4	.3	.7	.3	.7	.6
11	1.0	2.4	52	3.5	7.3	.3	1.1	.3	.7	.5
12	1.0	2.2	52	3.0	7.8	.3	1.4	.4	.3	.4
13	.3		62	2.7	6.9	.4	1.1	.3	.2	.2
14	.4		22	2.8	6.0	2.0	3.9	.3	.2	.2
15	1.8		52	2.8	5.5	2.9	1.7	.3	.2	.1
16	1.9		22	3.5	8.6	1.4	.4	.3	.2	.1
17	2.0		14	4.3	11	1.8	1.2	.3	.3	.1
18	.8		14	6.0	15	2.9	1.1	.3	.3	.1
19	.7		3.5	6.9	16	4.5	.4	.2	.3	.1
20	.6		2.4	7.3	14	3.2	.6	.2	.4	.2
21	.6		3.8	10.0	15	3.9	.3	.3	.5	.3
22	.6		2.2	8.4	16	5.0	.3	.2	.4	.2
23	.5		2.1	6.2	13	2.9	.3	.2	.4	.3
24	.3		2.1	5.1	11	2.9	.3	.3	.4	.3
25	2.0		2.1	2.1	10	1.8	.3	.2	.2	.2
26	2.4		2.2	2.1	.3	2.0	.3	.2	.3	.2
27	2.0		2.2	10	.2	2.5	.2	.3	.2	.2
28	1.0		2.2	14	.2	1.1	.2	.2	.2	.5
29	.6		2.4	20	.2	1.0	.2	.2	.5	.6
30	.4			7.3	.1	.6	.2	.3	.6	.6
31	.4			8.4		.3		.4	.5	

Note.—Mean discharge estimated on account of ice as follows: Nov. 13–30, 0.3 second-foot; Dec. 1–31, 0.4 second-foot; Jan. 1 to Feb. 7, 0.5 second-foot.

Monthly discharge of Indian Creek at Adamsville, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2.4	0.3	0.96	59.0
November	18	....	13.1	78.0
December	....	....	.40	24.6
January	....	....	.50	30.7
February	62	.5	13.2	759
March	20	1.9	5.1	314
April	16	.1	9.15	544
May	5.0	.2	1.60	98.4
June	3.9	.2	.693	41.2
July	.5	.2	.294	18.1
August	67	.2	4.74	291
September	1.2	.1	.403	24.0
The year	67	.1	3.14	2,280

COAL CREEK NEAR CEDAR CITY, UTAH.

LOCATION.—In E. ½ sec. 13, T. 36 S., R. 11 W., 500 feet above power plant and 1¾ miles southeast of Cedar City, Iron County.

DRAINAGE AREA.—92.5 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 28, 1915, to September 30, 1916.

GAGE.—Vertical staff on right bank August 24 to September 30, 1916; May 28 to July 24, 1915, vertical staff about 150 feet upstream; July 29, 1915, to August 4, 1916, vertical staff at approximately same site as present gage. These gages have no established relation to a common datum. Read by J. T. Wilkinson.

DISCHARGE MEASUREMENTS.—Made from highway bridge about a mile below, or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and boulders; shifting.

EXTREMES OF DISCHARGE.—Not determined.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—The only important diversion above the station is power canal, which returns the water to the stream about 500 feet below gage. This diversion is fairly constant, 6 to 8 second-feet, and should be added to obtain the total flow above Cedar City.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during floods. Rating curves poorly defined. Staff gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating tables, or interpolated or estimated for days of missing or defective gage height. Records poor.

Discharge measurements of Coal Creek near Cedar City, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	L. W. Jordan	0.67	2.2	Apr. 1	C. C. Jacob	1.00	87.6
Feb. 10	J. J. Sanford	.64	7.9	May 30	A. B. Purton	1.53	151

Discharge measurements of Coal Creek tailrace near Cedar City, Utah, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	L. W. Jordan	0.95	7.3	Apr. 1	C. C. Jacob	0.90	7.6
Feb. 10	J. J. Sanford	.92	8.0	May. 30	A. B. Purton	.80	4.1

Daily discharge, in second-feet, of Coal Creek near Cedar City, Utah, for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.0	1.5	0.5	....	6	13	41	153	170	24	28	36
2	1.0	1.0	1.5	....	7	14	44	183	164	24	253	33
3	1.0	1.0	.5	....	8	14	48	261	170	23	1,300	33
4	1.0	1.0	1.5	....	8	16	48	340	180	20	....	33
5	1.0	1.0	1.0	....	8	14	54	415	189	20	....	33
6	.5	1.0	1.0	....	8	14	54	480	164	20	....	33
7	.5	3.0	.5	....	10	16	54	450	141	20	....	31
8	.5	2.0	1.5	....	8	12	54	415	141	20	....	51
9	.5	2.0	1.0	....	10	16	54	425	153	19	....	51
10	.5	2.0	.5	....	8	21	116	380	141	18	....	36
11	.5	1.0	.5	....	10	23	73	340	128	16	....	33
12	.5	1.5	2.0	....	11	26	58	315	116	15	....	33
13	.5	1.5	.5	....	12	26	54	253	103	16	....	33
14	.5	8.0	1.0	....	14	24	73	218	94	54	....	33
15	1.5	2.5	2.5	....	12	23	98	183	94	18	....	33
16	1.5	2.5	.5	10	14	24	96	183	94	16	....	33
17	1.5	1.5	8.5	8	12	33	94	202	81	14	....	33
18	1.5	1.5	1.0	12	12	33	90	268	72	14	....	33
19	1.5	1.5	1.0	7	13	33	81	189	62	14	....	33
20	1.5	1.5	1.0	7	12	48	94	183	58	13	....	33
21	1.0	1.5	1.0	12	12	94	121	210	54	14	....	33
22	1.0	1.0	1.0	12	12	73	176	238	48	14	....	94
23	1.0	1.0	1.0	7	14	69	226	202	41	14	....	38
24	1.0	1.0	1.0	7	14	51	276	158	40	14	24	38
25	1.0	.5	1.0	7	13	54	238	141	38	26	24	38
26	1.0	1.5	2.5	7	13	58	300	136	36	31	24	38
27	1.0	.5	.5	7	14	65	355	170	33	98	23	36
28	1.0	3.0	.5	2	14	54	370	186	31	26	24	36
29	1.0	1.5	.5	3	17	48	253	202	28	18	69	36
30	1.0	1.0	.5	4	....	41	203	189	26	24	44	36
31	1.0	....	.5	5	....	48	....	183	....	31	36	....

NOTE.—Gage not read Apr. 8, 16, 23, 30, May 7, 14, 21, 28, June 4, 11, 18, 24, 25, July 2, 9, 16, 23, 30; discharge interpolated. Gage out of order Aug. 4-23. Mean discharge Jan. 1-15 estimated 5 second-feet, because of ice.

See footnote to table of monthly discharge.

Monthly discharge of Coal Creek near Cedar City, Utah, for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1.5	0.5	1.0	60
November	8	.5	1.7	100
December	8.5	.5	1.2	75
January	12	2	6.2	380
February	17	6	11.2	645
March	94	12	35.4	2,180
April	370	41	153	9,100
May	480	136	253	15,600
June	189	26	96.3	5,730
July	98	13	22.8	1,400
September	94	31	37.4	2.230

NOTE.—Mean discharge of tailrace, about 8 second-feet, should be added to flow past the station to get total flow of Coal Creek.

MINOR BASINS IN NEVADA.

SNAKE CREEK NEAR BAKER, NEV.

LOCATION.—In NW. ¼ sec. 16, T. 12 N., R. 70 E., in White Pine County, at Mathews ranch, 3 miles below Tilford tungsten mine, 6 miles west of Garrison, Utah, 13 miles from Baker, Nev., and 67 miles southeast of Ely, Nev.

DRAINAGE AREA.—About 45 square miles (measured on maps issued by Forest Service).

RECORDS AVAILABLE.—June 23, 1916, to January 15, 1917, when station was discontinued; fragmentary record at gage 3 miles upstream August 13, 1913, to September 30, 1915.

Gage.—Vertical staff on left bank 50 feet below footbridge opposite ranch house; read by T. W. Mathews; original gage, vertical staff on right bank at tungsten mine 3 miles upstream, August 13, 1913, to September 30, 1915.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of coarse gravel. One channel. Banks not subject to overflow. Control fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 1.06 feet at noon June 23 (discharge, 28 second-feet); minimum stage, 0.07 foot at 9 a. m. December 8 (discharge not determined).

1913–1916: Maximum discharge, 85 second-feet, June 7, 1914; minimum discharge, 0.5 second-foot December 20, 1913.

Ice.—No information.

Diversions.—Small diversion for power at mine 3 miles upstream; water returned to stream above gage.

Regulation.—Effect of power diversion at mine not noticeable.

Accuracy.—Gage read to hundredths twice daily. Daily discharge not determined.

Discharge measurements of Snake Creek near Baker, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 23	[a] 2.15	26.4
23	[b] 1.06	28.3

[a] Measured at former gaging station. [b] Measured at new station 3 miles downstream.

Daily gage height, in feet, of Snake Creek near Baker, Nev., for the period June 23, 1916, to January 15, 1917.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1		0.95	0.54	0.28	0.38	0.32	0.24	0.24
2		.80	.54	.28	.38	.28	.24	.24
3		.95	.54	.26	.37	.28	.24	.24
4		.91	.60	.25	.36	.28	.24	.22
5		.89	.68	.25	.34	.30	.24	.22
6		.88	56	.25	.41	.29	.24	.22
7		.84	.53	.22	.40	.32	.12	.22
8		.86	.53	.23	.36	.22	.08	.22
9		.84	.50	.20	.35	.26	.08	.22
10		.83	.50	.18	.33	.30	.08	.22
11		.80	.47	.22	.33	.27	.08	.22
12		.80	.46	.22	.32	.16	.20	.22
13		.77	.44	.20	.32	.10	.22	.18
14		.80	.43	.20	.44	.10	.22	.18
15		.78	.39	.20	.38	.08	.22	.18
16		.78	.40	.17	.36	.12	.22	
17		.75	.40	.16	.34	.18	.22	
18		.74	.40	.18	.35	.22	.22	
19		.73	.40	.18	.33	.24	.22	
20		.65	.38	.18	.35	.24	.23	
21		.70	.38	.18	.34	.24	.22	
22		.67	.36	.22	.34	.24	.22	
23	1.06	.65	.32	.25	.34	.24	.22	
24	1.04	.65	.31	.23	.34	.24	.22	
25	.86	.64	.28	.22	.35	.24	.20	
26		.64	.26	.22	.34	.25	.16	
27	.86	.60	.27	.22	.34	.26	.16	
28	.86	.61	.35	.22	.32	.25	.16	
29	1.01	.58	.37	.22	.32	.25	.18	
30	.83	.57	.33	.22	.32	.24	.20	
31		.54	.30		.32		.22	

CLEVELAND CREEK NEAR OSCEOLA, NEV.

Location.—In sec. 19, T. 16 N., R. 67 E., 1½ miles southwest of Cleveland ranch buildings, 3 miles below mouth of canyon, 7 miles below junction of North and South forks, 12 miles northwest of Osceola, White Pine County, and 45 miles by road southeast of Ely.

Drainage area.—About 32 square miles (measured on maps issued by Forest Service).

Records available.—May 29, 1914, to December 31, 1916, when station was discontinued.

Gages.—No. 1, or lower gage, is vertical staff on left bank about 500 feet above diversion dam for main irrigation ditches, installed July 10, 1915, at same site, but datum 0.92 foot higher than inclined staff installed August 10, 1913; No. 2, or upper gage, is vertical staff on right bank about a mile above gage No. 1 and 200 feet above a ditch that is used intermittently. On account of its accessibility, gage No. 1 is read except when water is being carried in the upper ditch; readings by L. Snyder. (For dates that each gage was used see footnote to table of daily discharge.)

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of coarse gravel and small boulders; steep gradient; fairly permanent, but likely to shift during high water. Conditions are similar at the two gages but the control for the upper one is more permanent. Banks moderately low, with a fringe of willows; subject to overflow at extremely high stages.

Extremes of discharge.—Maximum discharge, 32 second-feet, May 9 (stage, upper gage, 1.22 feet); minimum discharge, 4.1 second-feet, December 18, 1916 (stage, upper gage, 0.72 foot).

1914–1916: Maximum discharge, 44 second-feet, June 3, 1914 (stage, upper gage, 1.40 feet); minimum discharge, 4.1 second-feet, December 18, 1916 (stage, upper gage, 0.72 foot).

Ice.—Stage-discharge relation seriously affected by ice at times.

Diversions.—Gage No. 2 is above all diversions.

Regulation.—Discharge as given shows the natural flow of stream, as the lower gage is not read when water is being diverted between the gages.

Accuracy.—Upper gage: Stage-discharge relation fairly permanent except as affected by ice December 16, 1915, to January 5, 1916, January 20 to February 7, and December 9–17, 24–29, 1916. Rating curve used October 6 to April 29 well defined between 5 and 50 second-feet; curve used May 10 to June 21 and November 12 to December 31, 1916, drawn parallel to preceding curve through a single measurement. Lower gage: Stage-discharge relation not permanent; gage not read during period of ice effect. Rating curve poorly defined. Gage read to hundredths three times a week. Daily discharge ascertained by applying gage height to rating table and by interpolating for days on which gage was not read, except for periods during which stage-discharge relation was affected by shifting control or by ice. Discharge for periods of ice effect estimated from observer's notes and weather records. Records only roughly approximate.

Discharge measurements of Cleveland Creek near Osceola, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 22, at lower gage	1.20	16.6
June 22, at upper gage	1.02	17.5

Daily discharge, in second-feet, of Cleveland Creek near Osceola, Nev., for the period Oct. 1, 1915, to Dec. 31, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16												
1	5.3	8.1	6.9	......	......	6.2	17	28	17	8.9	6.9	6.1
2	5.3	7.8	6.9	......	......	6.2	17	28	17	8.5	6.9	6.1
3	5.3	7.6	6.9	......	......	6.2	16	28	17	8.5	7.3	6.1
4	5.5	7.6	6.9	......	......	6.2	16	27	17	8.5	7.7	6.1
5	5.8	7.6	6.9	......	......	6.9	15	27	18	8.5	8.5	6.1
6	6.9	7.6	6.9	5.5	......	8.0	14	28	19	8.5	8.1	6.1
7	7.2	7.6	6.9	5.5	......	9.0	14	29	20	8.5	7.7	6.1
8	7.6	7.6	6.9	5.5	6.2	10	14	30	20	8.5	7.3	6.1
9	7.2	7.6	6.9	5.5	6.2	12	14	32	20	8.5	6.9	6.1
10	6.9	7.6	6.9	6.2	6.2	13	17	31	20	8.5	6.5	6.1
11	7.1	8.0	6.9	6.9	6.2	15	20	29	20	8.5	6.1	6.1
12	7.4	8.3	6.9	6.4	6.2	17	19	28	20	8.5	6.5	6.1
13	7.6	8.0	6.9	5.9	6.2	17	18	28	20	8.1	6.9	6.1
14	7.6	7.6	6.9	5.4	6.2	17	17	28	20	7.7	6.9	6.1
15	7.6	7.4	6.9	4.9	6.2	17	17	27	20	9.4	6.9	6.1
16	7.6	7.2	......	4.3	6.2	17	17	26	20	11.0	6.9	6.1
17	7.6	6.9	......	4.2	6.2	17	17	25	20	10.0	6.9	6.1
18	7.6	6.9	......	4.0	6.2	18	17	24	20	9.3	6.9	6.1
19	7.6	6.9	......	3.9	6.4	18	17	22	20	8.5	6.5	6.1
20	7.6	6.9	......	......	6.6	19	18	22	20	8.2	6.1	6.1
21	7.6	6.9	......	......	6.9	21	18	21	20	8.0	6.1	6.9
22	7.6	6.9	......	......	6.9	22	19	20	16	7.7	6.1	7.7
23	7.6	6.9	......	......	6.9	20	20	20	14	7.7	6.1	6.9
24	7.6	6.9	......	......	6.9	19	21	19	13	7.4	6.1	6.1
25	7.6	6.9	......	......	6.9	18	22	18	12	7.2	6.1	6.1
26	7.6	6.9	......	......	6.9	18	23	18	12	6.9	6.1	6.1
27	7.6	6.9	......	......	6.9	18	24	18	12	6.9	6.1	6.1
28	7.6	6.9	......	......	6.6	17	26	18	12	6.9	6.6	6.1
29	7.6	6.9	......	......	6.2	17	26	18	11	6.9	7.1	6.9
30	8.0	6.9	......	......	......	17	27	17	9.3	6.9	7.7	7.7
31	8.3	......	......	......	......	17	......	17	......	6.9	6.9	......

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1916				1916				1916			
1	8.5	7.7	7.2	11	6.9	7.7	......	21	7.7	8.8	5.4
2	9.1	7.7	6.8	12	7.7	9.7	......	22	7.7	8.8	6.0
3	9.8	7.7	6.5	13	7.7	9.7	......	23	7.7	8.4	6.6
4	10.0	7.7	6.2	14	7.7	9.7	......	24	7.7	8.0	......
5	11.0	7.7	5.8	15	7.7	9.7	......	25	7.7	8.0	......
6	11.0	7.7	5.5	16	7.7	9.7	......	26	7.7	8.0	......
7	11.0	7.7	5.2	17	7.7	9.7	......	27	7.7	7.8	......
8	8.5	7.7	4.8	18	7.7	9.2	4.1	28	7.7	7.5	......
9	8.0	7.7	......	19	7.7	8.8	4.4	29	7.7	7.2	......
10	7.5	7.7	......	20	7.7	8.8	4.8	30	7.7	7.2	8.3
								31	7.7	......	6.5

NOTE.—Discharge Oct. 1-5, 1915, and June 22 to Nov. 11, 1916, determined at lower gage; Oct. 6, 1915, to June 21, 1916, and Nov. 12 to Dec. 31, 1916, at upper gage. Mean discharge estimated on account of ice as follows: Dec. 16-31, 1915, 6.0 second-feet; Jan. 1-5, 5.5 second-feet; Jan. 20-31, 4.0 second-feet; Feb. 1-7, 5.5 second-feet; Dec. 9-17, 1916, 4.0 second-feet; Dec. 24-29, 8.0 second-feet.

Monthly discharge of Cleveland Creek near Osceola, Nev., for the period October, 1915, to December, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	8.3	5.3	7.19	442
November	8.3	6.9	7.33	436
December	....	....	6.44	396
January	....	....	4.83	297
February	6.9	....	6.22	358
March	22	6.2	14.8	910
April	27	14	18.6	1,110
May	32	17	24.2	1,490
June	20	9.3	17.2	1,020
July	11	6.9	8.19	504
August	8.5	6.1	6.82	419
September	7.7	6.1	6.29	374
The year	32	....	10.7	7,760
1916.				
October	11	6.9	8.24	507
November	9.7	7.2	8.31	494
December	....	....	5.84	359

CURRANT CREEK NEAR CURRANT, NEV.[1]

Location.—In sec. 25, T. 11 N., R. 58 E., 10 feet above highway bridge at Cazier's ranch, on road from Ely to Tonopah, 2½ miles below inflow from Cazier's reservoir, and 2 miles above Currant, Nye County.

Drainage area.—Not measured.

Records available.—May 5 to September 30, 1913; May 25, 1914, to September 30, 1916.

Gage.—Vertical staff on left bank 10 feet above highway bridge, June 24 to September 30, 1916; read by Edmund Cazier. Original gage nailed to downstream side of right bridge abutment, at different datum, washed out March 20, 1916.

Discharge measurements.—Made by wading or from bridge below gage.

Channel and control.—Bed composed of gravel and boulders; will probably scour. One channel at all stages. Banks high and clean.

Extremes of discharge.—Maximum stage recorded before gage was washed out, 3.7 feet, March 20 (discharge, 23 second-feet); minimum stage, 2.75 feet, October 10–20 and January 16 to March 7 (discharge, 4 second-feet).

1913–1916: Maximum discharge, 24 second-feet, April 30 and May 1, 1915; minimum discharge, 2.6 second-feet, September 3, 1913, and September 28, 1915.

Ice.—Stage-discharge relation not seriously affected by ice; stream fed by springs in canyon about half a mile above gage.

Diversions.—Three small irrigation ditches divert water above gage; total capacity 3 to 5 second-feet.

Regulation.—Flow somewhat affected by inflow from Cazier's reservoir, and by changes in irrigation ditches above gage.

Accuracy.—Stage-discharge relation not permanent. Rating curves very indefinite. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating tables except January 2–15, when mean was interpolated; determinations for period of high water, March 10–20, are probably too low. Records poor.

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[1] Called "Currant Creek at Cazier's ranch" in reports previous to 1915.

Discharge measurements of Currant Creek near Currant, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 19	A. B. Purton	2.81	5.1
June 24[a]	L. W. Jordan	[b]4.48	11.4

[a] Zero flow determined at gage height 3.70±0.1. [b] New gage, with new datum and new control.

Daily discharge, in second-feet, of Currant Creek near Currant, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	June.	July.	Aug.	Sept.
1	5	5	5	5	4	4		11	8	5
2	5	5	5		4	4		11	8	5
3	5	5	5		4	4		11	8	5
4	5	5	5		4	4		12	7	5
5	5	5	5		4	4		13	7	5
6	5	5	5		4	4		13	7	5
7	5	5	5		4	4		12	7	5
8	5	5	5		4	5		12	7	5
9	5	5	5		4	5		12	7	5
10	4	5	5		4	6		12	7	5
11	4	5	5		4	10		14	7	5
12	4	5	5		4	13		9	7	5
13	4	5	5		4	12		9	7	5
14	4	5	5		4	14		9	7	5
15	4	5	5		4	16		9	7	5
16	4	5	5	4	4	16		9	7	5
17	4	5	5	4	4	17		9	7	5
18	4	5	5	4	4	19		9	7	5
19	4	5	5	4	4	19		9	7	5
20	4	5	5	4	4	23		9	7	6
21	5	5	5	4	4			9	7	6
22	5	5	5	4	4			9	7	6
23	5	5	5	4	4			9	6	6
24	5	5	5	4	4		11	9	6	6
25	5	5	5	4	4		11	9	6	6
26	5	5	5	4	4		11	9	6	6
27	5	5	5	4	4		11	9	6	6
28	5	5	5	4	4		11	9	5	6
29	5	5	5	4	4		11	8	5	6
30	5	5	5	4			11	8	5	6
31	5		5	4				8	5	

NOTE.—Mean discharge interpolated on account of break in record Jan. 2–8, 5 second-feet; Jan. 9–15, 4 second-feet. Gage washed out on March 20 and no records were obtained until June 24.

Monthly discharge of Currant Creek near Currant, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	5	4	4.65	286
November	5	5	5.00	298
December	5	5	5.00	307
January	5	4	4.26	262
February	4	4	4.00	230
March 1–20	23	4	10.2	403
June 24–30	11	11	11.0	153
July	13	8	10.0	615
August	8	5	6.68	411
September	6	5	5.37	320

BIG WARM SPRING NEAR DUCKWATER, NEV.

Location.—300 yards below spring, about 1 mile south of Duckwater, Nye County, and about 50 miles south of Eureka.

Records available.—October 1, 1915, to September 30, 1916.

Gage.—Stevens 8-day water-stage recorder on left bank, 150 feet above head gate of Tognoni's ditch, installed November 21, 1915. Inspected by Geo. Saxton.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of sand with tules at edge. Head gate of Tognoni's ditch forms control. One channel about 1½ feet deep.

Extremes of discharge.—Maximum discharge during year, from discharge measurement, made August 25, 14.6 second-feet; minimum, from discharge measurement, made September 8, 1915, 13.2 second-feet.

Ice.—None.

Diversions.—Above all diversions.

Regulation.—None.

Accuracy.—Stage-discharge relation not permanent. Daily gage height from water-stage recorder practically disregarded and discharge estimated between current meter measurements. Flow of spring practically constant. Records good.

Discharge measurements of Big Warm Spring near Duckwater, Nev., during the period Sept. 8, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Remarks.
		Feet.	*Sec.-ft.*	
Sept. 8	A. B. Purton		13.2	Miscellaneous measurement, gage not yet installed.
Nov. 21	do	1.62	13.6	Gate to swamp open, Tognoni's gate closed; 1.0 second-foot leakage.
May 5	L. W. Jordan	1.65	14.3	Gate to swamp open, Tognoni's gate closed; 0.93 second-foot leakage.
6	do	1.65	14.4	Gate to swamp open, Tognoni's gate closed; 0.93 second-foot leakage.
June 25	do	1.67	14.4	
Aug. 25	do	1.56	14.6	

Monthly discharge of Big Warm Spring near Duckwater, Nev., for the year ending Sept. 30, 1916.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	13.3	818	May	14.4	885
November	13.5	803	June	14.4	857
December	13.5	830	July	14.5	892
January	13.5	830	August	14.6	898
February	13.5	776	September	14.6	869
March	13.5	830			
April	14.1	839	The year	14.0	10,100

DUCKWATER CREEK NEAR DUCKWATER, NEV.

Location.—In T. 12 N., R. 56 E., 200 feet below old stone building, 1½ miles below Duckwater, Nye County, 2 miles by present channel below Big Warm Spring, and about 50 miles south of Eureka.

Drainage area.—Indeterminate. Stream fed by springs.

Records available.—September 7, 1915, to September 30, 1916.

Gage.—Lietz water-stage recorder on left bank, 15 feet above weir. Inspected by Ed. Halstead.

Discharge measurements.—Made by wading 50 feet above weir.

Channel and control.—Bed composed of sand; dense growth of aquatic plants above weir pool; sharp-crested Cippoletti weir with 4.04-foot crest serves as control. One channel at all stages.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 0.90 feet at 2.30 p. m. January 28 (discharge, 12.1 second-feet); minimum stage, 0.40 feet, October 23 (discharge, 3.7 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—A few small ditches divert from creek above gage.

Regulation.—During summer of 1915, flow from Big Warm Spring was conducted to creek through a canal. From October 11, 1915, to September 2, 1916, flow of spring was allowed to follow natural course into large slough, creek being supplied by seepage from slough and overflow of nearly 2 second-feet.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between zero and 12 second-feet. Operation of water-stage recorder satisfactory except for occasional breaks in records due to stopping of clock. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting recorder graph, except for days when clock was not running for which it was interpolated. Records excellent.

Discharge measurements of Duckwater Creek near Duckwater, Nev., during the period Sept. 7, 1915, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Sept. 7	A. B. Purton	0.86	11.5	May 5	L. W. Jordan	0.76	9.8
9	do	.86	11.2	June 25	do	.64	7.5
Nov. 20	do	.55	6.0	Aug. 25	do	.68	8.1

Daily discharge, in second-feet, of Duckwater Creek near Duckwater, Nev., for the period Sept. 7, 1915 to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		8.9	4.4	6.2	8.4	10.0	9.3	9.5	9.5	7.7	7.6	7.2	8.1
2		8.8	4.5	6.4	8.4	9.7	9.3	9.5	9.5	7.6	7.6	7.2	8.1
3		8.9	4.5	6.4	8.4	9.5	9.3	9.5	9.5	7.6	7.6	7.2	8.1
4		9.0	4.5	6.5	8.4	9.5	9.3	9.5	9.5	7.6	7.4	7.2	8.1
5		9.2	4.5	6.7	8.4	9.1	9.3	9.5	9.5	7.6	7.4	7.2	8.1
6		9.3	4.5	6.9	8.4	9.5	9.1	9.5	9.5	7.4	7.4	7.4	7.9
7	11.3	9.4	4.5	7.0	8.4	9.5	9.1	9.5	9.5	7.4	7.4	7.4	7.9
8	11.2	9.5	4.7	7.0	8.6	9.5	9.1	9.5	9.3	7.4	7.4	7.4	7.7
9	11.2	6.9	4.8	7.2	8.6	9.7	9.1	9.5	9.3	7.4	7.4	7.4	7.7
10	11.2	4.3	5.0	7.2	8.6	9.7	9.3	9.7	9.3	7.4	7.4	7.2	7.7
11	9.3	4.3	5.1	7.4	8.6	9.8	9.3	9.7	9.3	7.4	7.4	7.7	7.7
12	9.8	4.3	5.3	7.4	8.8	9.5	9.3	9.7	9.1	7.4	7.4	8.1	7.6
13	10.2	4.1	5.4	7.4	8.6	9.5	9.5	9.5	9.1	7.4	7.4	8.1	7.6
14	10.6	4.1	5.4	7.6	8.8	9.8	9.5	9.5	9.1	7.4	7.4	8.1	7.6
15	10.3	4.1	5.6	7.6	8.9	9.1	9.5	9.5	9.1	7.4	7.4	8.1	7.4
16	10.0	4.1	5.6	7.6	8.9	8.9	9.5	9.7	9.1	7.4	7.4	8.1	7.4
17	9.8	4.1	5.6	7.6	10.	8.8	9.5	9.8	9.1	7.4	7.4	8.1	7.3
18	9.5	4.0	5.7	7.6	10.	8.8	9.5	9.8	8.5	7.4	7.4	8.1	7.1
19	9.5	3.9	5.7	7.6	9.5	8.8	9.5	9.8	8.1	7.4	7.2	8.1	7.0
20	9.5	3.9	5.9	7.6	9.1	8.8	9.5	10.	7.9	7.4	7.2	8.1	6.9
21	9.5	3.8	5.9	7.7	8.9	8.8	9.5	10.	7.9	7.4	7.2	8.1	6.7
22	9.5	3.7	6.1	7.9	9.1	8.8	9.5	9.8	7.9	7.6	7.2	8.1	6.7
23	9.3	3.7	6.1	8.1	9.3	8.8	9.5	9.8	7.9	7.6	7.2	8.1	6.7
24	9.3	3.8	6.2	8.1	9.8	8.8	9.5	9.8	7.9	7.6	7.4	8.1	6.5
25	9.3	3.9	6.2	8.1	10.	8.9	9.5	9.8	7.9	7.4	7.4	8.1	6.5
26	9.3	4.0	6.2	7.9	10.	9.1	9.5	9.8	7.7	7.6	7.4	8.1	6.4
27	9.3	4.1	6.2	7.9	9.8	9.1	9.5	9.8	7.7	7.6	7.2	8.1	6.2
28	9.1	4.2	6.2	7.9	9.8	9.1	9.5	9.7	7.7	7.6	7.2	8.1	6.2
29	9.1	4.3	6.2	8.1	10.	9.1	9.5	9.5	7.7	7.6	7.2	8.1	6.2
30	8.9	4.4	6.2	8.1	10.		9.5	9.5	7.7	7.6	7.2	8.1	6.1
31		4.4		8.1	10.		9.5		7.7		7.2	8.1	

Note.—Daily discharge interpolated, Sept. 12-13, 15-17, Oct. 3-7, 9, 17-22, 24-29, Jan. 9, July 9-12 and Sept. 17-20.

Monthly discharge of Duckwater Creek near Duckwater, Nev., for the period Sept. 7, 1915 to Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
September 7-30	11.3	8.9	9.83	468
1915-16.				
October	9.5	3.7	5.46	336
November	6.2	4.4	5.42	323
December	8.1	6.2	7.45	458
January	10.0	8.4	9.11	560
February	10.0	8.8	9.24	531
March	9.5	9.1	9.40	578
April	10.0	9.5	9.66	575
May	9.5	7.7	8.66	532
June	7.7	7.4	7.49	446
July	7.6	7.2	7.35	452
August	8.1	7.2	7.82	481
September	8.1	6.1	7.24	431
The year	10.	3.7	7.86	5,700

LEES CREEK NEAR PAHRUMP, NEV.

Location.—In sec. 6, T. 20 S., R. 56 E., 10 feet above old weir, 16 miles northeast of Manse ranch and 22 miles east of Pahrump, Clark County.

Drainage area.—Not measured.

Records available.—April 1 to September 30, 1916, when station was discontinued.

Gage.—Stevens 8-day water-stage recorder on right bank 10 feet above old weir; inspected by A. M. Quill.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of large boulders; gradient steep. Control is rectangular suppressed wier with 6.68 feet crest. One channel at all stages. Except at extremely high water entire flow of creek sinks in gravel bed within about 5 miles from gage.

Extremes of discharge.—Maximum stage during period, from water-stage recorder, 1.45 feet at 2.30 a. m. July 15 (discharge, 37 second-feet); minimum stage, 0.16 foot, September 27–29 (discharge, 0.5 second-foot).

Ice.—No information.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between 0 and 22 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph. Records excellent.

Discharge measurements of Lees Creek near Pahrump, Nev., during the period Apr. 1 to Oct. 6, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 2	L. W. Jordan	0.90	8.8	July 7	A. M. Quill	0.52	1.8
7	A. M. Quill	.80	6.5	14	.....do	.50	1.5
14	.....do	.82	6.9	21	.....do	.52	1.9
21	.....do	1.00	12.8	28	.....do	.49	1.4
28	.....do	1.12	17.5	Aug. 4	.....do	.48	1.5
May 5	.....do	1.02	13.4	11	.....do	.44	1.2
12	.....do	.90	8.9	18	.....do	.40	1.2
19	.....do	.80	6.5	25	.....do	.38	1.0
26	.....do	.72	5.3	Sept. 1	.....do	.34	.9
June 2	.....do	.70	4.9	8	.....do	.30	0.8
9	.....do	.68	4.5	15	.....do	.24	0.6
16	.....do	.64	3.6	22	.....do	.20	0.6
23	.....do	.58	2.6	29	.....do	.16	0.5
30	.....do	.56	2.4	Oct. 6	.....do	.18	.5

Daily discharge, in second-feet, of Lees Creek near Pahrump, Nev., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.0	12.0	4.9	2.4	1.5	0.9	16	10.0	7.1	3.8	3.7	1.2	0.7
2	8.9	11.0	4.7	2.4	1.7	.9	17	12.0	6.6	3.7	2.9	1.1	.7
3	8.7	12.0	4.7	2.3	1.6	.9	18	12.0	6.2	3.5	2.6	1.1	.6
4	8.0	14.0	4.7	2.3	1.5	.9	19	12.0	6.4	3.5	2.3	1.0	.6
5	7.3	15.0	4.5	2.2	1.5	.9	20	12.0	6.0	3.2	2.0	1.0	.6
6	6.8	13.0	4.5	2.2	1.4	.8	21	13.0	6.0	3.0	1.9	1.0	.6
7	6.8	12.0	4.5	1.7	1.4	.8	22	14.0	6.2	2.7	1.9	1.0	.6
8	8.0	12.0	4.4	1.6	1.4	.8	23	16.0	6.2	2.7	1.9	1.0	.6
9	9.9	11.0	4.4	1.6	1.4	.8	24	18.0	5.8	2.8	1.7	1.0	.6
10	12.0	10.0	4.4	1.6	1.3	.8	25	18.0	5.5	2.8	1.6	1.0	.6
11	11.0	9.6	4.4	1.6	1.3	.7	26	20.0	5.1	2.7	1.6	1.0	.5
12	8.9	9.2	4.2	1.6	1.3	.7	27	20.0	5.3	2.6	1.6	1.0	.5
13	7.8	8.4	4.0	1.6	1.3	.7	28	20.0	5.3	2.4	1.5	1.0	.5
14	7.3	8.0	4.0	2.0	1.2	.7	29	19.0	5.3	2.4	1.5	.9	.5
15	8.4	7.5	4.0	12.0	1.2	.7	30	16.0	5.3	2.4	1.5	.9	.5
							31	......	5.1	......	1.5	.9	......

Monthly discharge of Lees Creek near Pahrump, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	20	6.8	12.0	714
May	15	5.1	8.32	512
June	4.9	2.4	3.68	219
July	12	1.5	2.28	140
August	1.7	.9	1.20	73.8
September	0.9	.5	.69	41.1
The period	20	.5	4.09	1,700

INTERMITTENT SPRINGS NEAR PAHRUMP, NEV.

Location.—In sec. 6, T. 21 S., R. 56 E., 500 feet below spring, 13 miles east of Manse ranch, and 19 miles southeast of Pahrump, Clark County.

Drainage area.—Indeterminate. Stream fed by three springs, the flow of which is intermittent.

Records available.—March 31 to September 30, 1916, when station was discontinued.

Gage.—Stevens 8-day water-stage recorder on left bank, 20 feet about old weir; inspected by A. M. Quill.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of large boulders; steep gradient. Control is 7-foot rectangular, contracted weir. One channel at all stages. Except at extreme high water, entire flow of creek sinks into gravel of stream bed within 8 to 10 miles of source.

Extremes of discharge.—Maximum stage during period, from water-stage recorder, 1.60 feet, April 29 (discharge, 39 second-feet); minimum stage, 0.47 foot, September 29 and 30 (discharge, 0.4 second-foot).

Ice.—No information.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge determined by applying to rating table, the mean daily gage height determined by inspecting recorder graph. Records excellent.

Discharge measurements of Intermittent Springs near Pahrump, Nev., during the period Mar. 31 to Oct. 5, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 31[a]	L. W. Jordan	1.40	25.1	July 6	A. M. Quill	0.92	7.8
Apr. 6	A. M. Quill	1.26	16.2	13	.....do	.84	6.0
13	.....do	1.32	20.4	20	.....do	.92	7.7
20	.....do	1.38	24.6	27	.....do	.84	6.0
27	.....do	1.56	35.8	Aug. 3	.....do	.84	5.8
May 4	.....do	1.51	32.9	8	.....do	.78	4.5
11	.....do	1.52	33.0	17	.....do	....	3.7
18	.....do	1.35	22.1	24	.....do	.68	2.8
25	.....do	1.26	18.4	31	.....do	.64	2.4
June 1	.....do	1.20	15.6	Sept. 7	.....do	.60	1.7
8	.....do	1.24	17.3	14	.....do	.56	1.1
15	.....do	1.22	16.7	21	.....do	.52	.76
22	.....do	1.10	12.7	28	.....do	.48	.52
29	.....do	1.00	9.9	Oct. 5	.....do	.48	.48

[a] Point of zero flow determined at gage height 0.6±.05.

Daily discharge, in second-feet, of Intermittent Springs near Pahrump, Nev., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	36	16	9.4	5.0	2.2	16	20	24	17	13.0	4.0	1.2
2	22	33	16	9.1	5.7	2.2	17	23	23	16	10.0	3.7	1.1
3	22	32	16	8.6	5.7	2.0	18	24	22	16	9.1	3.5	1.1
4	21	33	16	8.1	5.2	2.0	19	24	22	15	8.3	3.3	1.0
5	20	34	16	7.8	5.0	1.9	20	24	21	14	7.8	3.1	.9
6	18	35	17	7.8	5.0	1.8	21	25	20	14	7.6	3.0	.8
7	18	34	17	7.3	4.8	1.6	22	26	19	13	7.3	3.0	.8
8	18	33	18	7.1	4.8	1.5	23	28	19	12	6.6	3.0	.8
9	19	33	18	6.8	4.8	1.5	24	31	19	12	6.4	2.8	.6
10	22	33	18	6.4	4.6	1.4	25	32	18	12	6.4	2.6	.6
11	24	33	18	6.4	4.6	1.4	26	33	17	11	6.2	2.4	.6
12	22	33	18	6.2	4.4	1.3	27	36	16	11	5.9	2.5	.5
13	21	31	17	5.9	4.2	1.3	28	38	16	10	5.7	2.6	.5
14	20	29	17	5.9	4.2	1.3	29	39	16	9.9	5.2	2.5	.4
15	20	26	17	15.0	4.0	1.3	30	38	16	9.6	5.0	2.4	.4
							31	......	16	......	5.0	2.2	......

Monthly discharge of Intermittent Springs near Pahrump, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	39	18	25.0	1,490
May	36	16	25.5	1,570
June	18	9.6	14.9	887
July	15	5.0	7.53	463
August	5.7	2.2	3.83	236
September	2.2	.4	1.20	71.4
The period	....	....	....	4,720

SALTON SINK BASIN.

SALTON SEA NEAR SALTON, CAL.

Location.—Near the mouth of Salt Creek, 1 mile west of Durmid, 2½ miles east of Salton, Riverside County, and 7 miles east of Mecca.

Records available.—November, 1904, to Sept. 30, 1916.

Gage.[1]—Vertical staff in several sections fastened to piling. Gage is graduated to feet and inches and is inverted (reads down) with its zero at 6.1 feet above mean sea level, U. S. G. S. datum. To obtain depths subtract reading from 279.6 feet because the lowest point in bottom of Salton Sea is at 273.5 feet below mean sea level, U. S. G. S. datum. Gage is read by an employee of Southern Pacific Co. Original gage, read November 1, 1904, to February 26, 1906, was established about 3½ miles northwest of Salton by New Liverpool Salt Co. and read depths directly. First Survey gage, read March 2, 1906, to June 5, 1906, half a mile west of Salton, also read depths directly. First Southern Pacific Co.'s gage, read June 6, 1906, to July 5, 1909, was at present location with its zero at 6.8 feet above mean sea level, U. S. G. S. datum. Readings from its inverted scale, subtracted from 280.35 feet, gave depths in Salton Sea. Second Survey gage, read July 6, 1909, to April 21, 1914, at the same place, read elevations below mean sea level, U. S. G. S. datum. Readings subtracted from 273.5 feet gave depths. The present gage has been read since April 24, 1914.

Extremes of depth.—Maximum depth during year, 38.2 feet, October 1; minimum depth, 33.95 feet, September 29.

1904–1916: Maximum depth, 76.0 feet, February 10 to March 29, 1907; minimum depth, no water at gage November 1 to 14, 1904.

Cooperation.—The Southern Pacific Co. has furnished the record since June 30, 1914.

Area of sea January 1, 1909, was 443 square miles.

Practically all the water now received by Salton Sea enters through Alamo and New Rivers, chiefly through the former. These rivers run through Imperial Valley and are drainage channels for excess and waste waters from the irrigation system and from the power plants. The following table shows the depth of Salton Sea:

Daily depth, in feet, of Salton Sea near Salton, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38.2						36.8					34.6
2									36.3			
3			36.6			36.95						
4					36.95						35.35	
5		37.35						36.6				
6												
7				36.35			36.8			35.9		
8	38.0											34.45
9									36.2			
10			36.5			36.95						
11					36.95						35.1	
12		37.2						36.5				
13												
14				36.35			36.75			35.75		
15	37.85											34.25
16									36.15			
17			36.5			36.9						
18					36.95						34.95	
19		37.1						36.45				
20												
21				36.35			36.7			35.6		
22	37.7											34.1
23									36.05			
24			36.45			36.9						
25					36.95						34.75	
26		37.0						36.4				
27												
28				36.35			36.7			35.5		
29	37.5											33.95
30									36.0			
31			36.4			36.85						

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[1] History of gages previously published in water-supply papers incomplete, and some statements regarding datums erroneous.

OWENS LAKE BASIN.

OWENS RIVER NEAR ROUND VALLEY, CAL.

Location.—In SE. ¼ sec. 10, T. 6 S., R. 31 E., below Sheep Bridge, 700 feet above mouth of Rock Creek and 2 miles north of Round Valley, Inyo County.

Drainage area.—About 450 square miles.

Records available.—August 4, 1903, to September 30, 1916.

Gage.—Vertical staff on left bank 85 feet below bridge; read by W. D. Roberts. The datum differs from that of the previous gage, which was 100 feet above the present one and used prior to May 29, 1907.

Discharge measurements.—Made from cable at gage.

Channel and control.—Rock and boulders; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 3.20 feet at 7.20 a. m. June 17 (discharge, 625 second-feet); minimum stage recorded, 1.70 feet November 28 and December 1 (discharge, 132 second-feet).

1903–1916: Maximum stage recorded, 4.0 feet June 30, 1907 (discharge, 1,190 second-feet); minimum discharge recorded, 120 second-feet September 21, 1913.

Ice.—Shore ice exists at times but ordinarily does not affect the stage-discharge relation.

Diversions.—No water is diverted above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent; not affected by ice during year. Rating curve fairly well defined. Gage read to hundredths about every other day. Daily discharge ascertained by applying daily gage height to rating table for days when gage was read and interpolating discharge for days between (see footnote to daily-discharge table). Records good except for the high water of June, which are fair.

Cooperation.—Gage-height and discharge-measurement records furnished by the city of Los Angeles.

Discharge measurements of Owens River near Round Valley, Cal., during the year ending Sept. 30, 1916.

[Made by J. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 12	2.00	188	Apr. 28	2.35	290	July 28	2.55	354
Dec. 15	1.93	180	May 29	2.45	314	Aug. 25	2.20	244
Mar. 9	2.10	210	June 21	3.00	610	Sept. 25	2.11	215

Daily discharge, in second-feet, of Owens River near Round Valley, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	177	a 190	132	156	a 229	242	a 250	291	335	a 354	242	229
2	a 174	192	a 136	a 166	270	a 233	285	a 304	a 366	242	a 236	a 222
3	170	a 192	141	177	a 263	224	a 298	318	398	a 242	229	216
4	a 176	192	141	a 168	256	a 208	310	a 309	a 402	a 242	a 229	a 229
5	181	a 192	a 150	160	a 263	192	a 314	300	405	242	229	224
6	a 176	192	160	a 160	270	a 204	318	a 318	a 425	a 238	a 222	a 220
7	170	a 181	a 160	160	a 263	216	a 326	335	445	a 233	216	216
8	a 174	170	160	a 165	256	a 216	335	a 326	a 461	229	a 208	a 216
9	177	a 169	a 170	170	a 249	216	a 358	318	477	a 329	a 200	216
10	a 174	168	181	a 168	242	a 216	380	294	a 488	a 430	192	192
11	170	a 169	a 176	166	229	216	a 392	300	498	530	a 192	a 192
12	192	170	170	a 168	a 210	192	405	a 291	a 492	a 508	192	192
13	a 192	a 170	160	170	192	a 208	a 415	282	485	485	a 192	a 192
14	192	170	a 165	a 169	a 192	224	425	a 291	a 508	a 485	192	192
15	181	170	170	168	192	a 208	457	300	530	485	a 196	a 192
16	170	177	a 170	170	a 192	192	a 451	a 292	a 578	a 485	a 200	192
17	188	170	170	a 177	192	229	445	285	625	485	204	a 192
18	a 190	a 170	a 165	a 185	a 192	216	a 425	a 278	a 612	a 461	a 198	192
19	192	170	160	192	192	a 258	405	270	600	437	192	a 202
20	a 192	a 163	a 165	188	181	300	a 411	a 290	a 565	a 441	a 190	211
21	192	156	170	a 190	285	242	417	310	530	445	188	204
22	a 192	a 151	a 170	192	242	a 239	a 408	a 305	a 565	a 425	a 179	a 210
23	192	146	170	192	229	a 236	398	300	600	405	170	216
24	a 192	a 144	a 165	a 192	216	a 232	a 366	a 318	a 576	a 411	a 188	a 219
25	192	141	160	192	a 250	229	335	335	552	417	206	219
26	a 192	a 141	160	a 190	285	a 222	a 326	a 335	a 541	370	170	a 212
27	192	141	a 155	188	a 264	216	318	335	530	370	a 193	204
28	a 192	132	150	a 190	242	a 220	285	a 326	a 508	352	216	a 210
29	192	a 134	a 153	192	270	224	a 292	318	485	a 324	a 220	216
30	192	137	156	a 190	......	a 220	300	a 332	465	a 297	224	a 222
31	188	......	150	188	......	216	......	346	......	a 270	a 226	......

a No record; discharge interpolated.

Monthly discharge of Owens River near Round Valley, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	192	170	184	11,300
November	192	132	165	9,820
December	181	132	160	9,840
January	192	156	177	10,900
February	285	181	235	13,500
March	300	192	223	13,700
April	457	250	362	21,500
May	346	270	308	18,900
June	625	335	502	29,900
July	530	229	376	23,100
August	242	170	204	12,500
September	229	192	208	12,400
The year	625	132	258	187,000

OWENS RIVER NEAR BIG PINE, CAL.

Location.—In sec. 2, T. 11 S., R. 34 E., at Charlies Butte, 11 miles southeast of Big Pine, Inyo County.

Drainage area.—Not measured.

Records available.—September 20, 1906, to September 30, 1916.

Gage.—Vertical staff on left bank; read by J. E. Jones.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Sand and gravel; shifts slightly. Right bank high; left bank subject to overflow during floods.

Extremes of discharge.—Maximum stage recorded during year, 7.0 feet at 12 m. January 10 (discharge, 1,700 second-feet); minimum stage recorded, 1.2 feet September 11 to 15 and 18 (discharge, 154 second-feet).

1906–1916: Maximum stage recorded, 11.2 feet at about 9 p. m. January 26, 1914 (discharge, from extension of rating curve, about 3,220 second-feet); minimum stage recorded, —0.05 foot June 13 to 16, 1908 (discharge, 36 second-feet).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—On account of diversions above the station the record does not indicate the total run-off from the drainage area.

Regulation.—Flow partly regulated by diversions.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to half-tenths once a day, sometimes to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

Cooperation.—Gage-height and discharge measurement records furnished by the city of Los Angeles.

Discharge measurements of Owens River near Big Pine, Cal., during the year ending Sept. 30, 1916.

[Made by J. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 11	2.00	290	Mar. 11	3.58	607	May 27	2.15	309
Dec. 17	2.77	457	Apr. 1	3.42	625	June 17	4.20	854
Feb. 28	5.57	1,170	26	1.90	254	29	4.10	769
Mar. 7	4.01	740	May 11	2.20	329	Aug. 4	2.50	384
						22	1.60	222

Daily discharge, in second-feet, of Owens River near Big Pine, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	313	396	463	440	557	920	605	284	284	730	418	177
2	313	375	463	440	605	680	605	294	294	705	396	177
3	313	375	463	440	655	557	655	284	294	705	354	177
4	294	396	486	605	705	557	605	275	294	705	396	177
5	294	396	509	730	655	805	605	266	294	680	440	185
6	294	396	533	680	655	860	605	275	313	705	463	185
7	294	396	509	655	655	755	605	294	375	705	463	185
8	294	396	486	630	655	705	605	294	418	755	418	185
9	294	418	486	1,100	680	655	605	294	509	805	375	194
10	284	396	486	1,700	680	655	630	354	557	805	333	185
11	294	396	486	1,040	705	655	630	333	605	805	333	154
12	275	396	486	755	705	655	655	294	655	805	294	154
13	275	396	463	680	705	655	605	375	655	805	284	154
14	284	418	486	655	730	630	557	375	680	805	284	154
15	284	418	509	605	730	630	581	418	705	805	275	154
16	294	418	463	581	755	605	581	418	755	830	266	162
17	294	440	463	581	805	605	655	418	805	830	256	162
18	294	440	486	581	780	605	557	440	860	830	238	154
19	294	440	486	630	805	605	509	418	920	755	220	169
20	313	463	463	655	950	605	440	396	1,040	730	229	177
21	294	463	463	605	1,100	630	375	396	950	705	220	169
22	294	463	486	605	1,380	705	375	396	920	705	220	185
23	294	463	509	630	1,490	680	354	396	860	655	211	194
24	294	463	486	630	1,320	655	313	375	755	705	185	169
25	333	463	486	655	1,250	605	294	354	705	705	185	177
26	354	440	486	630	1,160	605	275	333	755	730	185	194
27	354	463	463	655	1,280	605	275	333	755	730	177	202
28	375	440	463	655	1,250	605	294	333	780	605	177	220
29	375	463	463	630	1,040	605	275	313	780	557	177	238
30	375	463	509	533	......	605	275	313	755	509	177	256
31	375	......	440	533	......	630	......	294	......	463	177	......

Monthly discharge of Owens River near Big Pine, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	375	275	310	19.100
November	463	375	425	25,300
December	533	440	482	29.600
January	1,700	440	676	41,600
February	1,490	557	877	50,400
March	920	557	656	40,300
April	655	275	500	29,800
May	440	266	343	21,100
June	1,040	284	644	38.300
July	830	463	722	44.400
August	463	177	285	17,500
September	256	154	181	10.800
The year	1,700	154	507	368,000

OWENS RIVER NEAR LONE PINE, CAL.

Location.—In NW. ¼ sec. 23, T. 15 S., R. 36 E., at Mount Whitney highway bridge, about 2½ miles northeast of Lone Pine, Inyo County.

Drainage area.—Not measured.

Records available.—January 1, 1909, to September 30, 1916.

Gage.—Vertical staff fastened to a pile in channel at downstream side of bridge; read by G. F. Marsh. The high water, January 27–29, 1914, raised the pier to which gage was fastened 1.83 feet. Gage has not been reset.

Discharge measurements.—Made by wading or from cable about 1,000 feet below bridge.

Channel and control.—Sandy; fairly permanent. One channel at low stages; three or more during floods.

Extremes of discharge.—Maximum stage recorded during year, 8.95 feet on morning of February 25 (discharge, 1,390 second-feet); minimum stage recorded, 1.3 feet September 28 to 30 (discharge, 4 second-feet).

1909-1916: Maximum stage recorded, 10.6 feet July 7, 1909 (discharge, 2,050 second-feet); minimum stage recorded September 28 to 30, 1916.

Ice.—Shore ice sometimes forms at the station during very cold weather but probably does not affect the stage-discharge relation.

Diversions.—Record does not show total run-off from drainage area on account of diversions above station. The Los Angeles Aqueduct, which has its intake above the station, was formally opened February 13, 1913.

Regulation.—Flow is partly regulated by the diversions above.

Accuracy.—Stage-discharge relation changed slightly twice during year from caving of banks. Changes probably occurred December 8 and March 7. Rating curves for first and second periods, well defined; for third period well defined above 200 second-feet. Gage read to half-tenths once a day. Daily discharge ascertained by applying daily gage height to rating table. Records very good except for extreme low water in September which are probably fair.

Cooperation.—Gage-height and discharge measurement records furnished by the city of Los Angeles.

Discharge measurements of Owens River near Lone Pine, Cal., during the year ending Sept. 30, 1916.

[Made by J. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1908.	*Feet.*	*Sec.-ft.*	1909.	*Feet.*	*Sec.-ft.*	1911.	*Feet.*	*Sec.-ft.*
Oct. 6	3.35	216	Mar. 6	6.50	788	June 16	5.90	678
Dec. 21	4.74	408	21	5.30	542	Aug. 3	3.55	222
Feb. 18	6.70	832	May 4	3.90	300	31	2.45	78

Daily discharge, in second-feet, of Owens River near Lone Pine, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	203	349	459	292	520	1,120	619	166	255	495	375	86
2	210	349	459	310	500	1,100	597	180	270	300	375	86
3	218	366	459	460	582	1,070	619	225	270	270	375	80
4	218	366	459	500	670	1,050	619	270	270	300	300	80
5	218	384	459	604	692	670	619	270	240	355	240	61
6	218	384	459	648	692	648	597	270	240	415	225	53
7	210	384	479	692	738	906	495	285	285	435	210	45
8	210	384	499	762	810	817	495	285	300	455	210	37
9	210	384	440	786	786	707	495	300	355	455	210	30
10	210	384	420	834	786	707	495	300	395	495	210	23
11	210	384	420	882	762	685	300	300	415	535	202	23
12	210	402	400	906	762	641	255	300	435	597	202	17
13	218	421	382	1,000	762	641	285	300	435	575	202	17
14	218	421	382	906	762	641	415	300	455	575	202	14
15	218	421	382	762	786	619	597	300	535	575	152	12
16	218	421	382	762	810	619	619	300	685	597	145	12
17	218	421	364	762	810	619	395	300	707	597	108	12
18	218	421	346	738	858	619	210	335	773	597	102	12
19	218	421	292	714	858	619	166	315	817	619	102	10
20	218	440	420	738	882	597	152	315	839	619	96	10
21	226	440	420	762	906	555	152	255	883	619	91	8.0
22	218	440	400	714	1,150	555	225	210	883	619	91	8.0
23	218	440	400	670	1,190	555	210	126	905	619	91	8.0
24	218	440	382	670	1,270	575	225	202	930	619	91	8.0
25	218	440	382	670	1,400	575	225	195	930	575	91	8.0
26	218	440	382	648	1,300	575	210	285	861	575	86	6.0
27	218	440	382	520	1,220	575	180	270	751	555	86	6.0
28	281	440	382	460	1,150	555	173	270	729	535	86	4.0
29	298	459	364	274	1,120	555	166	240	663	495	86	4.0
30	332	459	364	274	......	555	166	240	663	455	80	4.0
31	332	......	346	382	......	575	......	240	......	415	82	......

Monthly discharge of Owens River near Lone Pine, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	332	203	228	14,000
November	459	349	412	24,500
December	499	292	405	24,900
January	1,000	274	648	39,800
February	1,400	500	880	50,600
March	1,120	555	687	42,200
April	619	152	366	21,800
May	335	126	263	16,200
June	930	240	572	34,000
July	619	270	514	31,600
August	375	80	168	10,300
September	86	4.0	26.1	1,550
The year	1,400	4.0	429	311,000

OWENS LAKE NEAR LONE PINE,[1] CAL.

Location.—On west shore of Owens Lake, 1 mile north of Brier siding on California & Nevada Railroad (Southern Pacific Co.), and about 9 miles south of Lone Pine, Inyo County.

Records available.—March, 1908, to September 30, 1916.

Gage.—Vertical staff, installed November 1, 1911, at a boulder point east of railroad culvert No. 507B; read when weather conditions permit accurate observations, by an employee of the city of Los Angeles. Original gage, a vertical staff near the old Smith ranch, was submerged in July, 1911, whereupon an upper section was installed. Gage datum before July 29, 1913, 3,564.90 feet above sea level, U. S. G. S. datum; after that date, 3,561.90 feet. January 12, 1915, gage was washed out but was replaced at same location and datum.

Extreme of stage.—1911–1916: Maximum stage recorded, 8.75 feet March 16 and April 7, 1912; minimum stage recorded, 4.3 feet November 22 and December 4, 1913.

Cooperation.—Record of elevations furnished by city of Los Angeles.

Elevations given in table are computed from original reading made on gage, the datum of which is stated in paragraph headed "gage." To reduce these elevations to mean sea level (U. S. G. S. datum), add 3,570 feet.

Elevation of water surface, in feet, of Owens Lake near Lone Pine, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1								8.35	8.00		7.95	
2	6.10		5.92		7.05	7.90						
3							8.35			8.00	7.95	
4	6.00							8.35				
5	5.90				7.10			8.40	8.00			7.35
6	6.00		6.00	6.20						8.00		
7					7.20		8.40				7.85	
8												7.30
9	6.00					8.15						
10			6.00	6.40			8.40			8.05	7.80	
11					7.30			8.30				
12	5.90								8.00			7.15
13						8.20	8.40		8.03			
14		5.70	6.00		7.38						7.75	7.10
15								8.20	8.00			
16	5.80		6.05	6.60		8.25						
17							8.40			8.05	7.60	
18	5.80	5.75										7.05
19								8.20	8.00			
20						8.30				8.05		
21			6.10		7.60		8.40				7.50	
22	5.90		6.10	6.80				8.20	8.05			7.00
23		5.88			7.65							
24			6.12	6.85		8.30				8.05	7.50	
25	5.90	5.88			7.65		8.40	8.20				7.00
26									8.00			
27			6.13			8.30				8.00		
28				7.00	7.80		8.40				7.50	
29					7.85			8.10				6.90
30	5.90	5.92	6.15			8.35			8.00			
31											7.45	

ROCK CREEK NEAR ROUND VALLEY, CAL.

Location.—In NE. ¼ SE. ¼ sec. 9, T. 6 N., R. 31 E., below highway bridge a short distance above mouth of Pine Creek, 2 miles northwest of Round Valley, Inyo County.

Drainage area.—About 46 square miles.

Records available.—August 3, 1903, to September 30, 1916.

Gage.—Vertical staff on left bank about 600 feet below bridge; read by W. D. Roberts. Prior to July, 1906, gage was at highway bridge.

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[1] Formerly known as "near Olancha."

Discharge measurements.—Made from footbridge at gage or by wading.

Channel and control.—Sand and cobblestones; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 2.78 feet at 2.30 p. m. June 19 (discharge, 157 second-feet); minimum stage recorded, 1.23 feet at 8 a. m. November 10 (discharge, 27 second-feet).

1903–1916: Maximum stage recorded, 5.0 feet January 25, 1914 (discharge, 360 second-feet); minimum stage recorded, 1.0 foot April 20 to 23, 1905 (discharge, 14 second-feet).

Ice.—Shore ice forms at times but probably does not affect stage-discharge relation.

Diversions.—Water for irrigation is diverted above the station.

Regulation.—Flow partly regulated by diversions.

Accuracy.—Stage-discharge relation changed frequently. Rating curves used December 10 to February 21, fairly well defined; February 22 to May 13 well defined; May 14 to June 19 and June 20 to July 13, fairly well defined. Gage read to hundredths about every other day. Daily discharge ascertained by applying daily gage height to rating table and interpolating discharge for days when gage was not read; shifting-control method used October 1 to December 9 and July 14 to September 20. Records fair.

Cooperation.—Gage-height and discharge measurement records furnished by the city of Los Angeles.

Discharge measurements of Rock Creek near Round Valley, Cal., during the year ending Sept. 30, 1916.

[Made by J. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 12	1.28	31	Apr. 28	1.40	38	July 28	1.65	66
Dec. 15	1.35	31	May 29	1.75	69	Aug. 27	1.45	47
Mar. 9	1.45	42	June 21	2.30	105	Sept. 25	1.20	30
23	1.40	38						

Daily discharge, in second-feet, of Rock Creek near Round Valley, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	36	[a]30	30	38	[a]52	52	[a]40	45	80	[a]65	55	47
2	[a]33	31	[a]31	[a]54	52	[a]47	42	[a]50	[a]90	58	[a]52	[a]49
3	30	[a]31	32	70	[a]48	42	[a]44	54	100	[a]60	48	51
4	[a]32	31	30	[a]59	44	[a]42	45	[a]55	[a]102	[a]63	[a]46	[a]49
5	33	[a]31	[a]32	48	[a]46	42	[a]46	56	105	65	44	47
6	[a]32	31	33	[a]46	48	[a]44	47	[a]58	[a]116	[a]60	[a]46	[a]45
7	31	[a]31	[a]34	43	[a]44	45	[a]46	59	128	[a]56	47	43
8	[a]32	31	34	[a]42	41	[a]44	45	[a]58	[a]126	51	[a]46	[a]43
9	34	[a]29	[a]34	41	[a]41	42	[a]42	56	123	[a]63	[a]44	43
10	[a]34	27	35	[a]40	41	[a]44	39	63	[a]124	[a]76	43	43
11	34	[a]30	[a]35	38	38	45	[a]38	67	124	88	[a]43	[a]43
12	31	33	35	[a]38	[a]38	39	36	[a]68	[a]126	[a]96	43	43
13	[a]32	[a]32	35	38	37	[a]40	[a]38	69	128	105	[a]44	[a]43
14	32	31	[a]34	[a]38	[a]36	42	39	[a]70	[a]130	[a]106	46	43
15	32	[a]32	34	37	35	[a]40	33	72	132	107	[a]46	[a]44
16	32	34	[a]34	47	[a]35	39	[a]35	[a]70	[a]143	[a]99	[a]45	44
17	34	31	35	48	35	40	37	67	154	91	45	[a]43
18	[a]33	[a]32	[a]33	52	[a]38	39	[a]35	[a]62	[a]156	[a]84	[a]44	42
19	32	33	31	[a]52	41	[a]46	33	58	157	77	42	[a]43
20	[a]32	[a]32	[a]32	52	38	52	[a]36	[a]62	[a]131	[a]78	[a]44	44
21	32	32	34	55	112	45	40	67	105	79	45	42
22	[a]32	[a]31	[a]34	[a]54	59	[a]42	[a]40	[a]66	[a]107	[a]74	[a]45	[a]39
23	32	30	35	52	56	39	39	65	109	68	45	36
24	[a]32	[a]30	[a]34	[a]54	52	[a]40	[a]40	[a]68	[a]110	[a]70	[a]47	[a]33
25	33	30	32	55	[a]66	40	42	72	110	73	49	30
26	[a]32	[a]30	34	[a]52	79	[a]41	[a]44	[a]74	[a]102	68	51	[a]34
27	31	30	[a]34	50	[a]69	42	45	76	94	68	48	37
28	[a]31	31	34	[a]52	59	[a]41	39	[a]72	[a]87	66	51	[a]35
29	31	[a]31	[a]33	55	56	40	[a]42	68	80	[a]68	[a]51	33
30	33	31	32	[a]54	......	[a]40	45	[a]72	72	69	51	[a]41
31	30	......	32	52	......	39	......	76	......	[a]62	[a]49	......

[a] No records; discharge interpolated.

Monthly discharge of Rock Creek near Round Valley, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	36	30	32.3	1,990
November	34	27	31.0	1,840
December	35	30	33.3	2,050
January	70	37	48.6	2,990
February	112	35	49.5	2,850
March	52	39	42.4	2,610
April	47	33	40.4	2,400
May	76	45	64.4	3,960
June	157	72	115.0	6,840
July	107	51	74.6	4,590
August	55	42	46.6	2,870
September	51	30	41.7	2,480
The year	157	27	51.6	37,500

PINE CREEK NEAR ROUND VALLEY, CAL.

Location.—In NE. ¼ SE. ¼ sec. 9, T. 6 S., R. 31 E., 300 feet above highway bridge, about 600 feet above junction with Rock Creek, and 2 miles northwest of Round Valley, Inyo County.

Drainage area.—About 32 square miles above mouth of canyon.

Records available.—August 3, 1903, to September 30, 1916.

Gage.—Vertical staff on left bank, 300 feet above bridge; read by W. D. Roberts. Prior to May 13, 1908, gage was 150 feet below highway bridge.

Discharge measurements.—Made from footbridge at gage or by wading.

Channel and control.—Lava rock and sand; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 6.0 feet at 2.10 p. m. June 19 (discharge, 244 second-feet); minimum stage recorded, 3.30 feet November 27, 28, 30, December 1 and 4 (discharge, 0.7 second-foot).

1903-1916: Maximum discharge recorded, 370 second-feet June 22, 1911; minimum stage recorded, 3.2 feet June 15, 1913 (discharge, 0.2 second-foot).

Ice.—Ice occasionally forms along shores at station, but it has never been known to have affected the stage-discharge relation.

Diversions.—Water is diverted above station for irrigation.

Regulation.—Probably diversions partly regulate the flow.

Accuracy.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths about every other day. Daily discharge ascertained by applying gage height to rating table and interpolating discharge for days when gage was not read. (See footnote to daily-discharge table). Records fair.

Cooperation.—Gage-height and discharge measurement records furnished by the city of Los Angeles.

Discharge measurements of Pine Creek near Round Valley, Cal., during the year ending Sept. 30, 1916.

[Made by J. E. Jones.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 12	3.60	5.4	Apr. 28	3.80	13.7	July 28	4.40	52
Dec. 15	3.62	6.2	May 29	3.88	16.2	Aug. 27	3.55	5.1
Mar. 9	3.62	6.6	June 21	5.05	120	Sept 25	3.60	5.8
23	3.62	6.7						

Daily discharge, in second-feet, of Pine Creek near Round Valley, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	[a] 3.2	0.7	4.5	[a] 7.4	9.0	[a] 4.5	12	24	[a] 54	38	5.8
2	[a] 1.5	3.2	[a] .9	[a] 11	9.0	[a] 9.0	5.8	[a] 13	[a] 29	62	[a] 20	[a] 5.8
3	1.5	[a] 3.8	1.1	18	[a] 9.0	9.0	[a] 5.8	14	34	[a] 49	1.1	5.8
4	[a] 1.8	4.5	.7	[a] 12	9.0	[a] 9.0	5.8	[a] 16	[a] 36	[a] 37	[a] 1.1	[a] 5.2
5	2.0	[a] 5.2	[a] 1.6	5.8	[a] 10	9.0	[a] 5.8	18	38	24	1.1	4.5
6	[a] 1.8	5.8	2.4	[a] 4.5	11	[a] 10	5.8	[a] 18	[a] 44	[a] 23	[a] 5.0	[a] 5.2
7	1.5	[a] 4.5	[a] 3.4	3.2	[a] 10	11	[a] 6.3	18	51	[a] 22	9.0	5.8
8	[a] 1.5	3.2	4.5	[a] 3.2	9.0	[a] 8.7	6.8	[a] 16	[a] 52	21	[a] 7.1	[a] 5.8
9	1.5	[a] 2.4	[a] 5.2	3.2	[a] 9.5	6.4	[a] 7.9	13	53	[a] 67	[a] 5.1	5.8
10	[a] 1.4	1.5	5.8	[a] 3.2	10	[a] 7.7	9.0	20	[a] 68	[a] 113	3.2	9.0
11	1.3	[a] 1.8	[a] 5.2	3.2	9.0	9.0	[a] 10	24	84	160	[a] 2.4	[a] 9.0
12	5.8	2.0	4.5	[a] 3.8	[a] 10	5.8	11	[a] 27	[a] 90	[a] 154	1.5	9.0
13	[a] 5.8	[a] 1.8	4.5	4.5	11	[a] 5.2	[a] 10	30	96	148	[a] 1.5	[a] 7.4
14	5.8	1.5	[a] 3.8	[a] 3.8	[a] 10	4.5	9.0	[a] 27	[a] 110	[a] 157	1.5	5.8
15	4.5	[a] 2.0	3.2	3.2	9.0	[a] 3.8	10	24	124	166	[a] 4.0	[a] 5.8
16	3.2	2.4	[a] 4.2	4.5	[a] 9.0	3.2	[a] 9.5	[a] 27	[a] 154	[a] 163	[a] 6.5	5.8
17	5.8	1.5	5.3	5.8	9.0	2.4	9.0	30	183	160	9.0	[a] 5.8
18	[a] 5.2	[a] 1.8	[a] 4.9	5.8	[a] 10	1.5	[a] 7.9	[a] 24	[a] 214	[a] 136	[a] 7.4	5.8
19	4.5	2.0	4.5	[a] 5.8	11	[a] 5.2	6.8	18	244	113	5.8	[a] 5.8
20	[a] 5.2	[a] 1.8	[a] 5.2	5.8	9.0	9.0	[a] 7.9	[a] 18	[a] 181	[a] 113	[a] 5.8	5.8
21	5.8	1.5	5.8	6.8	24	3.2	9.0	18	118	113	5.8	5.8
22	[a] 5.8	[a] 1.4	[a] 5.6	[a] 6.3	18	[a] 4.8	[a] 7.4	[a] 16	[a] 124	[a] 104	[a] 4.9	[a] 5.8
23	5.8	1.2	5.3	5.8	18	6.4	5.8	14	130	84	4.0	5.8
24	[a] 6.3	[a] 1.1	[a] 5.6	[a] 6.6	13	[a] 5.8	[a] 7.9	[a] 14	[a] 133	[a] 86	[a] 4.2	[a] 5.8
25	6.8	1.0	5.8	7.4	[a] 18	5.3	10	13	136	87	4.5	5.8
26	[a] 6.3	[a] .8	4.5	[a] 7.1	24	[a] 4.2	[a] 9.5	[a] 11	130	58	5.8	[a] 5.8
27	5.8	.7	[a] 4.5	6.8	[a] 18	3.2	9.0	9.0	124	62	4.5	5.8
28	[a] 5.8	.7	4.5	[a] 6.3	13	[a] 3.2	13	[a] 13	[a] 96	53	5.8	[a] 5.8
29	5.8	[a] .7	[a] 3.8	5.8	13	3.2	[a] 12	17	69	[a] 49	[a] 7.4	5.8
30	4.5	.7	3.2	[a] 5.8	....	[a] 3.2	11	[a] 19	45	[a] 46	9.0	[a] 5.8
31	3.2	....	3.2	5.8	....	3.2	....	21	....	[a] 42	[a] 7.4	....

[a] No record; discharge interpolated.

Monthly discharge of Pine Creek near Round Valley, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	6.8	1.3	4.03	248
November	5.8	.7	2.19	130
December	5.8	.7	3.98	245
January	18	3.2	5.98	368
February	24	7.4	12.1	696
March	11	1.5	5.94	365
April	13	4.5	8.31	494
May	30	9.0	18.5	1,140
June	244	24	100	5,950
July	166	21	87.9	5,400
August	38	1.1	6.43	395
September	9.0	4.5	6.09	362
The year	244	.7	21.8	15,800

MONO LAKE BASIN.

MONO LAKE NEAR MONO LAKE, CAL.

Location.—In lot 6, SE. ¼ NE. ¼ sec. 31, T. 2 N., R. 20 E., about 2 miles south of Mono Lake post office, Mono County.

Records available.—June 15, 1912 to September 30, 1916 (fragmentary).

Gage.—Vertical staff fastened to willow tree about 400 feet from Hammon's store; temporary gage at different datum about 300 feet northwest of old gage was used during 1916. Read by Tyler and Green.

Extremes of stage.—1912–1916: Maximum stage recorded, 13.3 feet May 27, 1915; minimum stage recorded, 7.93 feet December 11, 1913.

Cooperation.—The following gage-height record was furnished by United States Forest Service. July 13, 2.0 feet; August 23, 1.8 feet; September 28, 1.5 feet.

LEEVINING CREEK NEAR MONO LAKE, CAL.

Location.—In SE. ¼ SE. ¼ sec. 17, T. 1 N., R. 26 E., at ranger station in Mono National Forest about 3½ miles above mouth, 4 miles south of Mono Lake post office, Mono County.

Drainage area.—Not measured.

Records available.—November 17, 1910, to September 30, 1916 (fragmentary), when the station was discontinued.

Gage.—Vertical staff fastened to cottonwood tree on left bank, 250 feet below ranger station; read by J. B. Anderson.

Discharge measurements.—Made by wading near gage.

Channel and control.—Gravel; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 3.9 feet at 10 a. m. June 19 (discharge, 326 second-feet); minimum stage recorded, 2.3 feet, April 3, September 25 and 28 (discharge, 29 second-feet).

1910–1916: Maximum stage recorded, 4.9 feet June 19, 1911 (discharge, 750 second-feet); minimum stage recorded, 2.04 feet March 2, 1912 (discharge, 12 second-feet).

Ice.—Stage-discharge relation affected by ice.

Diversions.—Less than 100 acres are irrigated from this stream above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation probably permanent but has not been verified by discharge measurements since 1914. Rating curve well defined above 80 second-feet and fairly well defined below. Gage read to half-tenths occasionally. Discharge ascertained by applying gage height to rating table.

Cooperation.—Gage-height record furnished by United States Forest Service.

Daily discharge, in second-feet, of Leevining Creek near Mono Lake, Cal., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	90	......	......	......	......	16	......	......	......	......	......	39
2	......	......	......	200	......	......	17	62	......	......	......	......	......
3	29	......	......	200	......	......	18	......	......	......	......	......	......
4	......	......	......	......	......	......	19	......	......	326	200	......	......
5	......	......	140	......	105	......	20	......	......	......	......	......	......
6	......	......	......	......	......	50	21	......	......	......	......	62	......
7	......	......	......	......	105	......	22	......	140	......	......	......	......
8	......	122	......	......	......	......	23	......	......	......	200	......	......
9	......	......	......	......	......	......	24	75	......	......	......	......	......
10	50	......	......	270	......	......	25	......	......	......	......	......	29
11	......	......	......	......	......	44	26	......	......	270	......	......	......
12	......	......	245	......	......	......	27	......	......	......	......	......	......
13	......	......	......	......	......	......	28	......	......	......	......	......	29
14	......	......	......	......	......	......	29	......	105	......	122	......	......
15	......	122	......	......	68	......	30	......	......	......	......	56	......
							31	......	......	......	......	......	......

WALKER LAKE BASIN.

EAST WALKER RIVER NEAR MASON, NEV.

Location.—In sec. 26, T. 12 N., R. 25 E., at highway bridge 2½ miles above junction with West Walker River and 7 miles above Mason, Lyon County.

Drainage area.—1,230 square miles.

Records available.—November 21, 1910, to September 15, 1912; July 5, 1913, to September 30, 1916. From 1902 to 1908 a station was maintained at Ross ranch, a short distance above present station.

Gage.—Inclined staff on left bank 50 feet below highway bridge, August 1, 1914, to September 30, 1916; inspected by Mrs. J. H. Hilburn. Original gage, vertical staff on left bank, November 21, 1910, to September 15, 1912, and July 5, 1913, to September 30, 1913; inclined staff on right bank at 0.31 foot lower datum, October 1, 1913, to June 22, 1914; temporary staff gage on left bank 25 feet below highway bridge, July 1 to July 31, 1914.

Discharge measurements.—Made by wading or from highway bridge 50 feet above gage.

Channel and control.—Bed composed of loose sand. Banks cave at high stages. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 5.2 feet March 29 (discharge, 528 second-feet); minimum stage, 0.90 foot, October 10–13, 19–21, and 26–30 (discharge, 29 second-feet).

1910–1916: Maximum stage recorded, 8.3 feet January 26, 1914 (discharge, 1,470 second-feet); minimum stage, 1.6 feet August 6, 1913 (discharge, zero).

Ice. Stage-discharge relation affected by ice for short periods.

Diversions.—Water to irrigate about 10,000 acres is diverted above the station.

Regulation.—Only by irrigation diversions.

Accuracy.—Stage-discharge relation not permanent; affected by ice January 13–29. Standard rating curve based on 1915 measurements fairly well defined; other curves used for 1916, each parallel to standard curve and rather indefinite, drawn through measurements. Gage read to half tenths once daily. Daily discharge determined by applying daily gage height to rating tables except for periods when stage-discharge relation was affected by shifting control or ice. Records poor.

Discharge measurements of East Walker River near Mason, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 17	1.30	96	Mar. 17	4.06	271	Aug. 19	1.03	33.4
Jan. 14	[a]1.89	109	June 9	2.70	208	19	[b]1.11	112

[a] Shore ice below gage.

[b] Measurement made at upper station.

Daily discharge, in second-feet, of East Walker River near Mason, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	41	35	79	58	63	221	480	390	174	361	101	60
2	41	35	80	56	82	203	441	413	174	361	89	69
3	41	35	81	47	103	186	402	413	191	361	89	69
4	41	35	82	39	113	169	386	390	191	361	89	69
5	35	35	83	38	184	154	370	367	191	361	89	69
6	35	35	84	37	181	154	354	346	191	361	79	60
7	35	35	85	57	179	140	339	325	209	361	79	60
8	35	35	97	65	193	140	346	325	209	339	69	60
9	35	35	98	148	227	140	352	284	200	318	60	51
10	29	42	100	121	262	154	337	264	227	318	51	51
11	29	42	101	121	221	169	344	227	227	318	44	51
12	29	43	114	108	169	169	350	209	245	298	37	51
13	29	51	116	108	169	212	335	209	264	298	31	51
14	35	52	117	109	169	221	342	227	270	298	31	44
15	35	53	118	....	154	240	327	227	296	278	31	44
16	35	62	120	....	154	259	312	227	323	240	31	44
17	35	63	96	....	169	278	298	227	350	240	31	37
18	35	65	94	....	169	298	284	209	379	259	31	37
19	29	66	92	....	169	339	270	209	406	240	33	31
20	29	77	89	....	169	383	276	209	383	221	31	31
21	29	78	87	....	154	452	262	191	361	203	31	31
22	35	79	86	....	169	475	268	191	339	203	37	37
23	35	80	84	....	169	498	274	191	318	203	37	37
24	35	81	82	....	186	429	280	191	318	203	44	37
25	35	82	80	....	186	383	288	191	298	186	44	31
26	29	73	78	....	186	339	312	191	318	169	51	31
27	29	74	77	....	203	318	318	191	339	154	51	31
28	29	75	75	....	203	452	325	191	361	126	51	37
29	29	77	73	....	221	528	352	191	361	113	51	37
30	29	78	61	56	....	512	381	191	361	101	51	44
31	35	....	60	56	....	496	....	174	....	101	60	....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 9 and Jan. 9-31, from a rating curve fairly well defined between 0 and 200 second-feet, taken as standard shape; Feb. 11 to Mar. 28, May 1 to June 13, and June 20 to Sept. 30, from three different curves, each parallel to standard curve; Dec. 17 and Jan. 14, from discharge measurements; Nov. 10 to Dec. 16, Dec. 18 to Jan. 8, Feb. 1-10, Mar. 29 to Apr. 30, and June 14-19, by shifting-control method. Discharge interpolated, because of ice, Jan. 15-29, 82 second-feet.

Monthly discharge of East Walker River near Mason, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	41	29	33.5	2,060
November	82	35	56.9	3,390
December	120	60	89.3	5,490
January	148	37	79.2	4,870
February	262	63	172	9,890
March	528	140	294	18,100
April	480	262	334	19,900
May	413	174	251	15,400
June	406	174	282	16,800
July	361	101	257	15,800
August	101	31	52.7	3,240
September	69	31	46.4	2,760
The year	528	29	162	118,000

WALKER RIVER AT MASON, NEV.

LOCATION.—In sec. 33, T. 13 N., R. 25 E., at highway bridge at Mason, Lyon County, about 4½ miles below junction of East Walker and West Walker rivers.

DRAINAGE AREA.—2,370 square miles.

RECORDS AVAILABLE.—November 21, 1910, to September 15, 1912; July 3, 1913, to September 30, 1916, when station was discontinued.

GAGE.—Vertical staff fastened to downstream pile of second bent from right end of bridge; read by H. C. Hansen.

DISCHARGE MEASUREMENTS.—Made from bridge at gage.

CHANNEL AND CONTROL.—Bed composed of loose sand; control is rock and brush diversion dam about 400 feet downstream from gage; small canal heads just above right end of dam; occasional changes in dam affect stage-discharge relation. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 7.48 feet June 18 and 19 (discharge, 1,850 second-feet); minimum stage, 4.30 feet September 20–25 (discharge, 36 second-feet). 1910–1916: Maximum stage recorded, 8.85 feet June 21–22, 1914 (discharge, 3,410 second-feet); minimum stage, 2.8 feet May 3–7, 1912 (discharge, 25 second-feet).

Ice.—Stage-discharge relation slightly affected by ice.

Diversions.—A large part of the flow of the East and West Walker rivers is diverted for irrigation.

Regulation.—Flow affected by irrigation diversions.

Accuracy.—Stage-discharge relation not permanent; affected by ice January 20 to February 6. Standard rating curve fairly well defined between 250 and 1,500 second-feet; curves drawn parallel to it to fit the shifting conditions during year. Gage read to half tenths twice daily. Daily discharge determined by applying mean daily-gage height to rating tables except for periods when stage-discharge relation was affected by shifting control or ice. Records fair.

Discharge measurements of Walker River at Mason, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 17	5.00	253	Mar. 17	5.50	530	Aug. 19	4.60	69
Jan. 14	[a] 4.99	263	June 10	6.95	1,470			

[a] Slight shore ice.

Daily discharge, in second-feet, of Walker River at Mason, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	69	148	178	194	......	354	828	1,020	691	1,020	194	69
2	69	138	180	194	......	326	742	989	638	1,050	158	69
3	68	140	180	202	......	295	686	957	664	1,070	144	63
4	68	140	197	233	......	301	686	926	675	1,020	......	63
5	72	142	225	233	......	326	742	1,060	747	989	......	57
6	72	142	233	214	......	310	713	1,120	834	1,070	......	57
7	73	144	250	190	415	295	686	1,170	1,010	1,020	......	57
8	73	154	250	185	419	295	686	1,090	1,160	1,050	......	57
9	74	156	253	230	432	295	713	926	1,190	1,120	......	57
10	81	146	253	236	527	301	799	864	1,420	1,050	......	52
11	89	148	239	239	648	368	951	834	1,430	970	......	52
12	89	148	239	225	736	407	1,100	804	1,450	957	......	52
13	90	148	225	217	606	432	864	730	1,500	944	......	52
14	98	150	239	233	532	462	764	719	1,500	957	......	52
15	99	167	267	239	484	484	719	719	1,450	895	......	52
16	107	169	282	239	476	508	804	719	1,580	804	......	52
17	112	152	253	239	440	541	775	747	1,700	719	......	46
18	117	165	239	239	440	591	804	719	1,850	638	......	44
19	119	165	239	239	440	675	787	747	1,850	612	69	41
20	127	167	253	235	440	752	719	747	1,520	571	69	36
21	129	178	253	230	419	858	719	719	1,360	489	69	36
22	129	185	253	220	476	888	719	775	1,120	466	69	36
23	129	204	256	215	432	919	775	834	989	458	67	36
24	131	207	256	220	399	919	895	822	1,010	476	63	36
25	131	194	256	230	354	799	895	764	1,160	458	59	36
26	142	197	241	230	361	713	895	691	1,190	433	63	41
27	142	185	230	225	392	741	957	586	1,260	376	63	41
28	142	187	217	220	399	828	989	551	1,290	320	69	46
29	142	176	204	222	399	951	989	612	1,260	267	69	46
30	156	178	204	220	......	1,020	1,070	638	1,170	239	69	46
31	156	......	204	220	......	951	......	719	......	212	72	......

Note.—Daily discharge determined from a series of parallel curves used as follows: Dec. 9–22, Jan. 11–19, Feb. 13 to Apr. 12, Apr. 13 to Aug. 3, and Aug. 19 to Sept. 30. Shifting control-method used Oct. 1 to Dec. 8, Dec. 23 to Jan. 10, and Feb. 7–12. Daily discharge estimated from weather records and by comparison with a composite hydrograph for the stations on East Walker near Mason and West Walker at Hudson Jan. 20–31. Mean discharge Feb. 1–6 estimated 320 second-feet; mean discharge Aug. 4–18 interpolated, 106 second-feet.

Monthly discharge of Walker River at Mason, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	156	68	106	6,520
November	207	138	164	9,760
December	282	178	234	14,400
January	239	185	223	13,700
February	736	....	434	25,000
March	1,020	295	578	35,500
April	1,100	686	816	48,600
May	1,170	551	817	50,200
June	1,850	638	1,220	72,600
July	1,120	212	733	45,100
August	194	59	95.4	5,870
September	69	36	49.3	2,930
The year	1,850	36	455	330,000

WALKER RIVER AT SCHURZ, NEV.

Location.—In sec. 36, T. 13 N., R. 28 E., at highway bridge at Schurz, Mineral County, 3 miles above Walker Lake and 6 miles below diversion dam of Walker River Indian Reservation.

Drainage area.—2,850 square miles.

Records available.—July 2, 1913, to September 30, 1916.

Gage.—Vertical staff on downstream pile of left abutment of highway bridge, about 300 feet from depot, August 4, 1914, to September 30, 1916; read by Joe Mencacci. Original gage, vertical staff fastened to tree on right bank about one-fourth mile above bridge, July 2, 1913, to July 1, 1914, when it was washed out by flood. Present gage at different datum.

Discharge measurements.—Made by wading or from highway bridge.

Channel and control.—Bed composed of loose sand; shifts occasionally. Banks cave at high stages. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 7.50 feet at 7 p. m. June 20 (discharge, 1,500 second-feet); minimum stage, 2.20 feet September 12–21, 23–26, and 30 (discharge, 1 second-foot).

1913–1916: Maximum stage recorded, 11.0 feet June 8 and 9, 1914 (discharge, 2,530 second-feet); minimum stage, 1.60 feet August 17–30, September 23 to October 18, 1913 (discharge, zero).

Ice.—Stage-discharge relation affected by ice; flow estimated from observer's notes and United States Weather Bureau reports from Yerington, Nev.

Diversions.—Below all diversions.

Regulation.—Flow affected by irrigation diversions above.

Accuracy.—Stage-discharge relation not permanent; affected by ice January 20 to February 3. Rating curves fairly well defined for ranges of stage occurring during periods for which they were applicable. Gage read to half-tenths twice daily. Daily discharge determined by applying mean daily gage heights to rating tables except during periods when stage-discharge relation was affected by ice or shifting control. Records fair.

Discharge measurements of Walker River at Schurz, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 18	4.13	241	June 10	6.15	919
Mar. 18	5.18	495	Aug. 20	2.35	3.9

Daily discharge, in second-feet, of Walker River at Schurz, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4	64	153	289	....	472	983	900	500	983	167	3
2	4	64	153	250	....	472	900	900	500	900	152	3
3	4	64	167	250	....	325	900	820	472	941	132	3
4	4	64	167	250	304	304	820	860	472	941	114	3
5	4	64	167	198	347	304	666	860	472	983	102	3
6	4	64	182	182	472	325	666	900	472	941	67	3
7	4	64	190	198	500	325	704	900	472	941	54	2
8	4	64	198	215	529	325	666	983	500	900	32	3
9	4	64	206	215	593	347	704	941	820	900	14	3
10	6	64	215	215	666	304	666	820	860	983	10	3
11	13	64	215	215	704	304	666	781	983	941	10	3
12	18	64	215	215	742	325	704	742	1,070	820	5	1
13	26	64	215	206	666	370	781	704	1,160	820	10	1
14	34	64	215	182	593	394	704	666	1,210	820	8	1
15	43	71	215	167	560	419	704	629	1,210	781	4	1
16	52	80	232	190	529	445	629	629	1,160	781	4	1
17	54	91	250	215	529	472	742	593	1,260	666	4	1
18	54	102	232	232	500	529	742	629	1,350	629	3	1
19	59	114	215	250	472	529	742	629	1,400	529	3	1
20	61	127	215	....	666	629	560	629	1,450	472	3	1
21	64	120	215	....	560	666	593	593	1,450	419	3	1
22	64	114	215	....	529	781	593	593	1,260	394	2	2
23	64	114	215	....	472	820	593	593	1,070	394	3	1
24	64	120	215	....	472	820	704	666	900	370	3	1
25	64	120	215	....	472	900	742	704	860	347	4	1
26	64	114	215	....	472	820	781	629	941	325	2	1
27	64	114	215	....	445	742	781	629	983	304	5	2
28	64	127	215	....	419	704	820	529	983	265	3	2
29	64	140	215	....	419	781	820	500	1,030	247	3	2
30	64	140	120	....	....	900	860	472	1,030	197	2	1
31	64	....	140	....	....	941	....	472	....	181	2	....

NOTE.—Discharge computed as follows: Oct. 1 to Jan. 19, from a rating curve fairly well defined below 350 second-feet; Feb. 4 to Aug. 6, from a rating curve fairly well defined between 200 and 1,200 second-feet; shift in control assumed to have occurred during ice-affected period Jan. 20 to Feb. 3; Aug. 7-18, discharge by shifting-control method; Aug. 19 to Sept. 30, from a rating curve fairly well defined for extreme low stages. Discharge estimated from observer's notes and weather records, Jan. 20-31, 200 second-feet; Feb. 1-3, 295 second-feet.

Monthly discharge of Walker River at Schurz, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	64	4	37.4	2,300
November	140	64	90.1	5,360
December	250	120	200	12,300
January	....	....	246	15,100
February	704	....	501	28,800
March	941	304	542	33,300
April	983	560	731	43,500
May	983	472	706	43,400
June	1,450	472	943	56,100
July	983	181	649	39,900
August	167	2	30.0	1,840
September	3	1	1.83	109
The year	1,450	1	389	282,000

WEST WALKER RIVER NEAR COLEVILLE, CAL.

LOCATION.—In NE. ¼ NW. ¼ sec. 28, T. 8 N., R. 23 E., at mouth of Ross Canyon, at head of Antelope Valley, 400 feet east of State highway, 1.2 miles above Terry ranch house, 5.5 miles above Coleville, Mono County, and about 40 miles southeast of Gardnerville, Nev.

DRAINAGE AREA.—245 square miles (measured on topographic maps).

RECORDS AVAILABLE.—March 1, 1909, to August 31, 1910; June 18, 1915, to September 30, 1916. October 5, 1902, to July 31, 1908, a station was maintained half a mile above present gage.

GAGE.—Water-stage recorder built by S. P. Ferguson, Reno, Nev., installed April 29, 1915, on left bank, 15 feet below large yellow pine tree, to which upper section of outside staff gage is fastened, and about 100 feet above Terry canal heading.

DISCHARGE MEASUREMENTS.—Made from cable 15 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders. Fairly permanent riffle. Stage-discharge relation affected at times by a temporary jetty built each year at the Terry canal heading. One channel at all stages.

EXTREMES OF DISCHARGE.—1915-16: Maximum stage, from water-stage recorder, 5.4 feet at 2 a. m. June 17, 1916 (discharge, 1,830 second-feet); minimum stage, 2.20 feet at 10 p. m. March 2, 1916 (discharge, 14 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice except for short periods.

DIVERSIONS.—Station is above all diversions in Antelope Valley.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent during two conditions of flow—when the jetty at the Terry canal heading is in place and when it has been destroyed by high water. The jetty was washed out April 29-30 and replaced August 9-11. Ice effect January 12 to February 5. Rating curves fairly well defined for ranges in stage for which used. Operation of water-stage recorder unsatisfactory October 1 to February 12; weekly readings on staff gage used for this period; recorder operation satisfactory February 13 to September 30. Daily discharge determined as follows: October 1 to January 9 and February 6, by applying weekly staff-gage readings to rating table; one current-meter measurement used January 12; discharge February 13 to September 30 ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph, except April 29-30 and August 9-11, when it was interpolated on account of changes in control, and July 24-30 on account of break in gage-height record. Mean monthly flow, October to January, inclusive, estimated from weekly gage readings. Records roughly approximate October 1 to February 12; fair February 13 to September 30.

Discharge measurements of West Walker River near Coleville, Cal., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 16	2.47	45.7	June 8	4.58	1,480
Jan. 12	[a]3.06	84	Aug. 17	3.19	233
Mar. 16	3.17	223			

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of West Walker River near Coleville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1						80	300	800	734	907	345	190
2	60					19	338	835	766	944	366	176
3						80	300	835	835	871	366	163
4						102	300	982	1,060	907	345	150
5			30			102	300	1,140	1,180	1,020	345	138
6					80	80	319	1,140	1,220	1,020	326	126
7		60				102	338	944	1,300	1,020	307	115
8						102	358	944	1,220	1,020	307	115
9				80		102	420	907	1,380	982	296	115
10	60					114	442	835	1,340	871	286	115
11						140	513	800	1,340	871	276	104
12		36	44	84		168	465	766	1,340	907	266	104
13					90	183	378	734	1,340	944	250	104
14					102	183	399	701	1,300	907	250	94
15					90	198	399	766	1,470	766	250	94
16			44		90	230	420	800	1,560	766	234	94
17	60				90	264	420	800	1,560	701	234	94
18					90	282	399	871	1,470	639	219	84
19					90	319	399	734	1,300	639	204	84
20					90	338	442	734	1,220	639	204	84
21					90	319	513	835	1,100	639	190	84
22		60	51		90	300	563	907	944	610	190	104
23					90	300	642	871	982	639	190	104
24	51				90	247	642	734	1,100		190	104
25					90	230	642	639	1,300		190	94
26					102	230	669	610	1,380		190	84
27					90	264	696	610	1,300		176	84
28		24			90	264	724	701	1,100		190	75
29					102	300	750	907	944		234	66
30						300	775	907	871		234	75
31	60					300		835		345	204	

NOTE.—Mean discharge estimated Feb. 1–5, 80 second-feet, and Feb. 7–12, 85 second-feet. Mean discharge interpolated because of break in gage record July 24–30, 492 second-feet.

Monthly discharge of West Walker River near Coleville, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October			[a] 58.0	3,570
November			[a] 48.0	2,860
December			[a] 45.0	2,770
January			[a] 80.0	4,920
February	102		88.1	5,070
March	338	19	201	12,400
April	775	300	476	28,300
May	1,140	610	827	50,800
June	1,560	734	1,200	71,400
July	1,020	345	743	45,700
August	366	176	253	15,600
September	190	66	107	6,370
The year	1,560	19	344	250,000

[a] Estimated on account of fragmentary records.

WEST WALKER RIVER AT HUDSON, NEV.

LOCATION.—About sec. 11, T. 11 N., R. 24 E., at highway bridge at Hudson, Lyon County, 1 mile above canyon, between Smith and Mason valleys.

DRAINAGE AREA.—About 953 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 3, 1914, to September 30, 1916.

GAGE.—Vertical staff fastened to downstream pile in middle bent of highway bridge; read by A. E. Purvine.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of loose sand. Light gravel riffle. One channel at all stages. Gage height of zero flow about 1.5 feet.

Extremes of discharge.—Maximum stage recorded during year, 6.3 feet at 7 a. m. June 18 (discharge, 1,710 second-feet); minimum stage, 2.40 feet October 1 and 2 (discharge, 38 second-feet).

1914–1916: Maximum stage June 18, 1916; minimum stage, 2.30 feet August 25 to September 3, 1915 (discharge, 31 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Below all diversions in Smith Valley and above those in Mason Valley.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; affected by ice as indicated in note to daily discharge table. Rating curve well defined between 30 and 1,500 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as noted in daily discharge table. Records good.

Discharge measurement of West Walker River at Hudson, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 16	3.30	153	June 9	5.85	1,360
Jan. 13	3.30	151	Aug. 19	2.75	79
Mar. 17	3.78	272			

Daily discharge, in second-feet, of West Walker River at Hudson, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	38	96	112	90		176	251	657	537	708	176	55
2	38	96	104	137		176	223	560	560	708	156	55
3	42	96	112	120		176	223	657	608	708	137	55
4	48	96	176	156		166	237	708		708	120	55
5	55	89	156	137	198	166	237	870		708	120	55
6	55	89	146	120	198	156	251	930		708	104	55
7	55	89	146	120	223	156	251	990		815	104	53
8	67	89	137	156	266	176	251	870		930	101	58
9	76	89	137	210	282	176	298	815		815	92	50
10	65	96	137	176	514	187	369	708		708	92	50
11	70	96	120	137	815	198	492	761		761	92	53
12	74	96	120	120	608	198	560	708		708	79	60
13	67	104	120	146	408	223	492	708		708	74	65
14	70	104	176	146	298	223	470	708		657	65	60
15	76	112	176	137	282	251	428	708	1,190	608	65	57
16	92	120	156	137	251	251	449	608	1,330	608	67	55
17	112	120	137	120	223	282	470	608	1,630	470	65	53
18	104	120	146	120	223	315	514	608	1,630	408	67	46
19	104	120	137	120	223	315	492	608	1,330	408	65	42
20	101	120	128	120	223	350	470	608	1,190	388	74	42
21	104	120	120	120	223	350	470	608	815	408	70	42
22	104	112			237	388	514	708	708	369	65	50
23	96	104			251	388	584	815	708	388	65	50
24	101	104			198	350	708	708	708	388	67	53
25	104	104			187	315	708	608	870	350	63	60
26	112	104			198	315	708	537	930	315	60	65
27	104	112	120		198	315	815	560	1,050	315	57	70
28	112	101	120		187	332	761	470	930	251	55	65
29	112	104	112		176	350	708	492	930	223	55	65
30	112	120	89			350	708	537	761	198	55	65
31	104		90			315		449		176	55	

Note.—Mean discharge estimated on account of ice: Dec. 22–26, 115 second-feet; Jan. 22–31, 125 second-feet; Feb. 1–4, 150 second-feet. Gage-height record June 4–14 appeared inconsistent; discharge determined from comparison with the record at Coleville, Cal.; June 4–8, 900 second-feet; June 9–14, 1,200 second-feet.

Monthly discharge of West Walker River at Hudson, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	112	38	83.0	5,100
November	120	89	104	6,190
December	176	89	129	7,930
January	210	90	132	8,120
February	815	....	265	15,200
March	388	156	261	16,000
April	815	223	470	28,000
May	990	449	674	41,400
June	1,630	537	1,000	59,500
July	930	176	536	33,000
August	176	55	83.3	5,120
September	70	42	55.0	3,270
The year	1,630	38	316	229,000

HUMBOLDT-CARSON SINK DRAINAGE BASIN.

CARSON RIVER BASIN.

EAST FORK OF CARSON RIVER NEAR MARKLEEVILLE, CAL.

Location.—In NE. ¼ sec. 27, T. 10 N., R. 20 E., at Hangman's bridge, 2 miles east of Markleeville, Alpine County. Indian Creek enters 100 feet above gage and Markleeville Creek 1½ miles below.

Drainage area.—Not measured.

Records available.—November 13, 1910, to September 30, 1916 (fragmentary).

Gage.—Vertical staff, 75 feet below bridge, bolted to rock ledge on right bank; read by W. J. Clark.

Discharge measurements.—Made from cable installed April 18, 1914, 400 feet below gage, or by wading.

Channel and control.—Gravel and small boulders; apparently permanent.

Extremes of discharge.—Maximum stage recorded during year, 6.3 feet June 7 and 8 (discharge, 1,480 second-feet); minimum stage recorded, 1.5 feet at 12.36 p. m. September 9 (discharge, 6 second-feet).

1910–1916: Maximum stage recorded, 7.7 feet June 7, 1911 (discharge not determined); minimum stage recorded, 1.45 feet September 20, 1913 (discharge, 6 second-feet).

Ice.—Stage-discharge relation affected by ice.

Diversions.—No information.

Regulation.—Low-water flow is augmented by storage developed on Silver Creek above the station.

Accuracy.—Stage-discharge relation permanent. No record this year during period of effect of ice. Rating curve fairly well defined above 40 second-feet. Gage read to half-tenths occasionally. Discharge ascertained by applying gage height to rating table. Records good for periods covered by gage-height record. On account of fragmentary gage-height record, monthly discharge has not been determined.

Cooperation.—Gage-height record furnished by United States Forest Service.

No discharge measurements were made at this station during the year ending September 30, 1916.

Daily discharge, in second-feet, of East Fork of Carson River near Markleeville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1								
2		54			794			
3							184	99
4	60							
5					1,130			
6	60				1,230		165	92
7				1,200	1,480	722		
8					1,480			7
9			745				156	6
10			794			675		
11						652		
12								
13	54							
14		54			1,400		24	
15					1,440			
16		60	698					78
17								92
18		49		928				99
19					956			106
20				755				98
21	54							106
22	54	60				370		106
23	54			900				106
24					1,040	340		
25							99	
26		66			985			106
27				608				
28				652	928		122	114
29								
30			900	928			204	114
31								

CARSON RIVER NEAR EMPIRE, NEV.

Location.—In sec. 12, T. 15 N., R. 20 E., just below tailrace of Brunswick mill, one-quarter mile below highway bridge and 2 miles below Empire, Ormsby County.

Drainage area.—988 square miles (measured on topographic map).

Records available.—June 25 to December 31, 1895; October 21, 1900, to September 30, 1916.

Gage.—Inclined staff on left bank used since February 24, 1911; vertical staff on left abutment of highway bridge, June 7, 1907, to February 23, 1911; prior to June 7, 1907, several gages at different points.

Discharge measurements.—Made from cable one-quarter mile above gage or by wading just above bridge. When made from cable the power canal is measured and the result added.

Channel and control.—Bed composed of gravel and boulders; fairly permanent. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 6.8 feet February 11 (discharge, 3,100 second-feet); minimum stage, 2.8 feet August 28 (discharge, 16 second-feet).

1895, 1900–1916: Maximum stage recorded, 8.0 feet January 23, 1914 (discharge 5,160 second-feet); minimum stage, 0.7 foot August 31 and September 4, 5, and 14, 1905 (discharge, zero).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—A large amount of water is diverted above the station for irrigation in Carson Valley. The water diverted by the Brunswick mill power canal is returned to river above gage.

Cooperation.—Records furnished by the United States Reclamation Service.

Discharge measurements of Carson River near Empire, Nev., during the year ending Sept. 30, 1916.

[Made by R. E. Hartley.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 1	5.70	1,536.4
July 25	3.80	199.3

Daily discharge, in second-feet, of Carson River near Empire, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	27	69	155	640	860	512	860	1,800	1,270	940	69	36
2	27	69	155	391	940	450	780	1,800	1,270	860	69	27
3	36	69	155	285	710	450	780	1,800	1,270	940	50	27
4	36	93	194	450	512	450	780	1,910	1,270	860	27	36
5	36	93	335	450	512	450	780	2,390	1,270	780	27	36
6	36	93	285	450	575	450	860	2,520	1,470	780	27	50
7	36	93	285	391	1,020	450	940	2,950	1,800	780	27	50
8	36	93	236	335	1,470	450	940	2,800	2,150	780	27	36
9	36	93	236	236	1,270	391	1,100	2,270	2,150	780	27	36
10	50	93	236	122	1,690	512	1,270	2,150	2,390	780	27	27
11	50	122	194	450	3,100	640	1,370	1,910	2,270	780	27	27
12	50	122	194	575	2,150	780	1,690	1,800	2,030	640	36	27
13	50	93	236	710	1,020	860	1,370	1,800	2,030	640	36	27
14	50	93	236	640	780	1,020	1,020	1,470	2,030	640	36	27
15	50	122	391	575	640	860	1,180	1,370	2,030	640	36	27
16	50	122	335	575	575	860	1,180	1,370	2,030	512	36	27
17	50	155	236	450	512	940	1,180	1,370	2,150	512	50	27
18	50	155	236	236	512	1,020	1,270	1,470	2,150	450	50	27
19	50	155	236	335	575	1,100	1,180	1,580	2,030	391	36	27
20	50	155	194	575	512	1,270	1,180	1,470	1,800	335	36	27
21	50	155	194	940	512	1,580	1,100	1,470	1,580	285	36	27
22	69	155	194	1,100	640	1,180	1,180	1,580	1,470	285	36	36
23	69	155	236	860	575	1,020	1,270	1,580	1,470	236	36	27
24	69	122	236	710	512	940	1,470	1,690	1,370	236	36	36
25	69	122	236	1,020	512	780	1,690	1,470	1,180	236	27	36
26	69	122	236	1,100	450	780	1,690	1,370	1,180	236	27	26
27	69	122	236	1,100	512	780	1,910	1,020	1,180	194	27	50
28	69	122	236	575	512	780	2,030	940	1,100	122	16	50
29	69	122	194	391	512	780	1,910	1,020	1,100	122	21	50
30	69	155	194	512	......	860	1,690	1,180	940	122	27	36
31	69	......	391	575	......	860	......	1,270	......	93	36	......

Monthly discharge of Carson River near Empire, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	69	27	51.5	3,170
November	155	69	117	6,960
December	391	155	237	14,600
January	1,100	122	573	35,200
February	3,100	450	851	49,000
March	1,580	391	782	48,100
April	2,030	780	1,260	75,000
May	2,950	940	1,700	105,000
June	2,390	940	1,650	98,200
July	940	93	516	31,700
August	69	16	34.9	2,150
September	50	27	33.8	2,010
The year	3,100	16	647	471,000

NOTE.—Monthly discharge computed by U. S. Geological Survey.

CARSON RIVER NEAR FORT CHURCHILL, NEV.

Location.—In sec. 5, T. 16 N., R. 23 E., 1 mile west of Clifton station, on Mound House-Churchill branch of Southern Pacific Railroad, 9 miles west of Fort Churchill, Lyon County, and 10 miles below Dayton.

Drainage area.—1,200 square miles (measured on topographic maps).

Records available.—April 13, 1911, to September 30, 1916.

Gage.—Inclined staff on right bank, with vertical extension for high water.

Discharge measurements.—Made from suspension bridge 500 feet above gage or by wading.

Channel and control.—Bed composed of sand and gravel; shifts occasionally.

Extremes of discharge.—Maximum mean daily discharge during the year ending September 30, 1915, 2,220 second-feet June 2 and 3; minimum mean daily discharge, 8 second-feet September 14 and 15.

Maximum mean daily discharge during the year ending September 30, 1916, 3,950 second-feet February 11; minimum mean daily discharge, 12 second-feet October 1-13.

1911-1916: Maximum mean daily discharge, 6,150 second-feet January 26, 1914; minimum mean daily discharge, 8 second-feet September 14-15, 1915.

Ice.—No information.

Diversions.—Carson and Dayton valleys are irrigated above the station.

Regulation.—Flow affected by diversions.

Cooperation.—Records furnished by United States Reclamation Service.

Discharge measurements of Carson River near Fort Churchill, Nev., during the year ending Sept. 30, 1915.

[Made by R. E. Hartley.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 18	5.10	719
May 31	7.30	2,340
July 18	4.20	282

Daily discharge, in second-feet, of Carson River near Fort Churchill, Nev., for the years ending Sept. 30, 1915 and 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	58	146	171	146	433	369	433	730	1,820	730	83	23
2	63	146	171	146	369	337	433	730	2,220	730	66	23
3	74	141	171	171	369	337	465	690	2,220	770	66	23
4	69	153	171	171	369	337	465	690	2,140	770	66	23
5	66	151	171	196	337	337	465	770	2,060	770	36	23
6	69	151	146	196	337	337	465	770	2,060	770	28	23
7	74	151	146	196	337	307	500	810	1,980	730	23	17
8	80	146	146	196	369	307	500	850	1,900	690	23	17
9	83	146	146	196	401	307	500	900	1,900	610	28	12
10	87	141	146	222	433	307	535	950	1,750	570	36	12
11	97	151	146	222	433	307	535	950	1,680	570	36	12
12	103	151	146	222	570	307	570	1,000	1,540	535	36	10
13	103	141	146	250	500	307	570	1,050	1,400	535	36	10
14	123	146	146	250	433	337	610	1,000	1,340	535	36	8
15	117	146	123	222	307	337	650	1,050	1,280	500	36	8
16	109	151	123	222	307	337	650	1,100	1,220	465	36	10
17	103	151	123	222	307	337	650	1,220	1,100	433	36	12
18	103	153	123	222	500	337	650	1,340	1,050	369	36	12
19	103	151	171	250	780	369	650	1,400	1,000	337	36	12
20	107	146	222	250	570	401	610	1,280	950	337	30	12
21	113	146	250	278	433	401	610	1,220	950	307	23	12
22	119	153	307	337	433	433	650	1,050	950	337	23	12
23	119	151	369	278	433	433	650	1,050	900	196	23	12
24	123	162	433	196	433	433	610	1,000	850	123	23	12
25	128	171	433	196	369	433	650	950	850	103	23	12
26	130	166	369	278	369	433	690	950	810	103	23	12
27	128	171	307	278	369	433	730	1,000	770	83	23	12
28	123	176	278	337	369	433	770	1,100	730	103	23	12
29	118	176	222	433	......	433	730	1,220	730	103	23	12
30	128	176	171	500	......	433	730	1,340	730	103	23	12
31	139	......	146	433	......	433	......	1,540	......	83	23	......

Daily discharge, in second-feet, of Carson River near Fort Churchill, Nev., for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.												
1	12	103	222	250	1,220	690	1,280	1,680	1,540	1,050	123	23
2	12	103	222	250	1,160	610	1,280	1,980	1,400	1,020	103	23
3	12	123	278	250	1,050	610	1,400	2,140	1,280	1,000	83	23
4	12	123	278	250	1,050	610	1,220	2,220	1,400	950	83	23
5	12	146	278	250	1,050	690	1,100	2,400	1,540	950	50	23
6	12	146	278	250	1,050	690	1,050	3,050	1,680	900	36	23
7	12	146	307	250	1,050	650	1,050	2,850	1,750	900	36	23
8	12	146	337	275	1,540	610	1,160	2,490	1,750	900	23	23
9	12	171	337	300	1,340	850	1,280	2,400	1,900	834	36	23
10	12	171	337	337	2,060	1,160	1,400	2,140	2,220	850	36	36
11	12	171	337	370	3,950	1,050	1,680	1,980	2,140	850	23	36
12	12	196	337	420	3,650	1,050	1,980	1,820	2,060	810	23	36
13	12	196	337	500	3,050	1,050	2,140	1,750	1,980	810	23	36
14	36	196	337	600	1,820	1,160	1,820	1,540	1,900	730	23	36
15	36	196	337	700	810	1,280	1,610	1,470	1,750	690	23	36
16	50	196	337	730	810	1,400	1,540	1,340	1,900	650	23	36
17	83	222	337	800	770	1,280	1,400	1,340	1,900	610	23	36
18	83	222	337	900	810	1,280	1,340	1,470	1,980	560	23	36
19	83	222	337	1,000	770	1,400	1,280	1,540	1,980	500	23	36
20	83	222	337	1,050	770	1,280	1,160	1,400	1,820	465	23	36
21	83	222	337	1,100	850	1,540	1,220	1,280	1,750	401	23	36
22	83	222	337	1,200	1,160	1,400	1,280	1,400	1,610	369	23	50
23	83	222	337	1,280	950	1,280	1,280	1,470	1,540	278	23	36
24	83	222	337	1,050	850	1,050	1,400	1,540	1,540	278	23	36
25	83	222	337	1,050	770	950	1,540	1,400	1,400	250	23	36
26	83	222	369	1,220	770	950	1,680	1,280	1,340	250	23	23
27	83	222	369	1,160	690	850	1,900	1,160	1,280	222	23	83
28	83	222	337	1,050	690	850	1,980	1,100	1,220	222	23	83
29	83	222	307	1,050	770	1,160	1,980	1,050	1,160	169	23	123
30	103	222	278	1,050	......	1,280	1,820	1,280	1,100	146	23	123
31	103	......	278	1,050	......	1,280	......	1,400	......	146	23	......

Monthly discharge of Carson River near Fort Churchill, Nev., for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1914-15.				
October	139	58	102	6,270
November	176	141	154	9,160
December	433	123	204	12,500
January	500	146	249	15,300
February	780	307	417	23,200
March	433	307	367	22,600
April	770	433	501	35,200
May	1,540	690	1,020	62,700
June	2,220	730	1,360	80,900
July	770	83	432	26,600
August	83	23	34.3	2,110
September	23	8	14.1	839
The year	2,220	8	411	297,000
1915-16.				
October	103	12	50.4	3,100
November	222	103	188	11,200
December	369	222	318	19,600
January	1,280	250	709	43,600
February	3,950	690	1,290	74,200
March	1,540	610	1,030	63,300
April	2,140	1,050	1,480	88,100
May	3,050	1,050	1,720	106,000
June	2,220	1,100	1,660	98,800
July	1,050	146	605	37,200
August	123	23	35.2	2,160
September	123	23	41.1	2,450
The year	3,950	12	756	550,000

NOTE.—Monthly discharge computed by United States Geological Survey.

MARKLEEVILLE CREEK[1] ABOVE MARKLEEVILLE, CAL.

Location.—At highway bridge above mouth of Pleasant Valley Creek, three-quarters of a mile above Markleeville, Alpine County.

Drainage area.—Not measured.

Records available.—November 7, 1911, to September 30, 1916 (fragmentary).

Gage.—Vertical staff in two sections on left abutment of bridge; read by Forest Service rangers. Datum of gage was raised 5.71 feet, August 18, 1914.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Gravel and small boulders; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 3.5 feet at 5.50 p. m. April 20 (discharge, 540 second-feet); minimum stage recorded, 0.7 foot at 4.30 p. m. September 19 (discharge, 0.1 second-foot).

1911–1916: Maximum stage recorded, 3.5 feet at 7 p. m. May 28, 1915, and at 5.50 p. m. April 20, 1916 (discharge, 540 second feet); minimum stage recorded, 0.7 foot September 19, 1916 (discharge, 0.1 second-foot).

Ice.—Stage-discharge relation occasionally affected by ice.

Diversions.—Town ditch, which heads above the gage, furnishes water for irrigation and domestic supply at Markleeville. Also, a small ditch diverts water for irrigation on Hot Springs ranch.

Regulation.—No information.

Accuracy.—Stage-discharge relation probably permanent; possibly affected by ice November 10, 13, and 15 as observer reported, "Creek full of ice." Rating curve well defined except for extreme low stages and high stages for which it has been extended. Gage read to half-tenths occasionally. Discharge ascertained by applying gage height to rating table. Records fair.

Cooperation.—Gage-height record furnished by United States Forest Service.

No discharge measurements were made at this station during the year ending September 30, 1916.

Daily discharge, in second-feet, of Markleeville Creek above Markleeville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1								1.5
2		1.4		230	172			
3				328				1.0
4	0.8			345				
5	1.0							
6	1.1							
7				245		76	5.5	
8	1.0							
9	1.0		125	230			5.5	1.5
10		5.5	135	200			3.5	
11			160			68		1.0
12			115	185	230			
13	1.2	7.2	115					1.5
14	1.2		125		260		3.5	1.0
15		5.5	131	200	292			
16				185	260			1.0
17		5.5	135					
18			135	200				.5
19	1.1		135			42		.1
20			540					.5
21						36		
22	1.0		172			42		
23	1.2							
24		3.1	215					
25			230					1.0
26		3.1	245					1.0
27			245					
28			230		160			1.0
29			185				4.5	
30					115			1.5
31								

Note.—Gage read twice daily Apr. 11, 13–15, 22, 26–28, and May 16.

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[1] Locally known as Hot Springs Creek.

MARKLEEVILLE CREEK AT MARKLEEVILLE, CAL.

Location.—In SE. ¼ sec. 21, T. 10 N., R. 20 E., at highway bridge at Markleeville, Alpine County, three-quarters of a mile below junction with Pleasant Valley Creek.

Drainage area.—Not measured.

Records available.—November 11, 1910, to September 30, 1916 (fragmentary).

Gage.—Vertical staff on left abutment of highway bridge near downstream end; read by Forest Service rangers.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Gravel and boulders; somewhat shifting during high water. Banks high and not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 4.2 feet at 5.52 p. m. May 4, 6.10 p. m. June 8, and 6.20 p. m. June 16 (discharge, 700 second-feet); minimum stage recorded, 0.80 foot at 8.20 a. m. October 2 (discharge, 4 second-feet) may have been lower September 16.

1910–1916: Maximum stage recorded, 5.3 feet June 15, 1912 (discharge, 915 second-feet); minimum stage recorded, 0.70 foot September 20, 1913 (discharge, 3 second-feet); may have been lower September 16, 1916. Flood of March, 1907, reached stage about 9 feet.

Ice.—Stage-discharge relation affected by ice.

Diversions.—See Markleeville Creek above Markleeville. Water is also diverted from Pleasant Valley Creek for irrigation purposes.

Regulation.—The diversions partly regulate the flow. Some storage has been developed on Pleasant Valley Creek.

Accuracy.—Stage-discharge relation considered permanent although no discharge measurements were made at this station during the year ending September 30, 1916. It may have been affected by ice November 13 to 15, as observer reported, "Creek full of ice." Rating curve fairly well defined below 500 second-feet and extended above. Gage read to half-tenths occasionally. Daily discharge ascertained by applying daily gage height to rating table.

Cooperation.—Gage-height record furnished by United States Forest Service.

Daily discharge, in second-feet, of Markleeville Creek at Markleeville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1								
2	4.0	8.0		424				
3		8.0		600				46
4				700				
5								
6	5.0				507			
7				507	507	150		
8	5.0				625			
9	5.0		263	444			18	9.0
10			290	406		130		
11			320			125		
12			237	387	464			
13	8.0	21	212					9.0
14	7.4	24	237		530		16	
15		9.0	263	352	562			
16		9.0	263		610			
17		9.0	263					
18		9.0	237	406				
19			237			77		9.0
20				314				8.0
21	8.0			464				9.0
22	8.0	8.0	320			71		
23	7.0							10
24		9.0	387			65		
25			424					
26		9.0	464					9.0
27			507	290				
28			464	290	263		11	9.0
29					224		27	
30			320	305	201		10	11
31								

Note.—Gage read twice daily Apr. 15, May 20, June 8, 15, 16, July 7, and Sept. 19.

WEST FORK OF CARSON RIVER AT WOODFORDS, CAL.

Location.—In SE. ¼ sec. 34, T. 11 N., R. 19 E., at highway bridge at Woodfords, Alpine County.

Drainage area.—70 square miles.

Records available.—April, 1890, to March, 1892; October 18, 1900, to September 30, 1915; April 12 to September 30, 1916.

Gage.—Vertical staff on right bank just above highway bridge, installed at independent datum August 21, 1914; read by Mrs. M. Merrill. Original gage, near present site, used April, 1890, to March, 1892. Vertical staff on left bank at cable half a mile above bridge read October 18, 1900, to May 18, 1907. Vertical staff on left bank just above highway bridge June 8, 1907, to November 10, 1913, except for certain periods in 1910 and 1911 when gage at cable was used. Vertical staff on right bank 20 feet above site of previous gage November 11, 1913, to August 20, 1914.

Discharge measurements.—Made from cable half a mile above gage or by wading.

Channel and control.—Fine gravel and boulders; section rough but fairly permanent.

Extremes of discharge.—Maximum stage recorded during period, 5.4 feet at 5 p. m. May 7 (discharge, 1,180 second-feet); minimum stage recorded, 0.9 foot September 3 (discharge, 11 second-feet).

1900–1916: Maximum stage recorded, 6.8 feet May 9 and 10, 1906 (discharge, 1,570 second-feet); minimum stage recorded 0.8 foot on several days in August and September, 1915 (discharge, 8 second-feet).

Ice.—Stage-discharge relation somewhat affected by ice. No record during winter of this year.

Diversions.—Three irrigation canals divert on right bank between cable and gage. The water is used mainly for irrigation in California. Their flow is not included in record.

Regulation.—Flow partially regulated by diversions.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between 20 and 100 second-feet; fairly well defined above 100 second-feet. Gage read to half tenths twice daily from April 12 to June 30 and once daily July 1 to September 30. Daily discharge determined by applying mean daily gage heights to rating table except for days when gage was not read, for which it was interpolated. Records good.

Discharge measurements of West Fork of Carson River at Woodfords, Cal., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 13[a]	L. W. Jordan	1.70	64
June 7[b]	Jacob and Jordan	3.23	469
Aug. 16[c]	L. W. Jordan	1.60	54

[a] Cable gage read 1.35 feet. No water in canals.
[b] Cable gage read 3.50 feet.
[c] Cable gage read 1.20 feet. No water in canals.

Daily discharge, in second-feet, of West Fork of Carson River at Woodfords, Cal., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	637	386	186	77	14	16	418	484	326	186	53	14
2	......	742	434	186	77	12	17	402	371	271	144	53	23
3	......	742	534	125	77	11	18	326	386	233	144	44	29
4	......	814	500	125	77	18	19	371	356	164	164	44	29
5	......	1,030	500	125	70	18	20	418	356	144	164	36	29
6	......	958	500	125	64	18	21	450	356	144	164	29	29
7	......	1,070	450	125	53	23	22	500	356	154	164	29	36
8	......	1,030	434	125	64	26	23	568	341	164	144	29	36
9	......	958	386	125	64	29	24	637	312	154	144	29	36
10	......	922	356	186	64	29	25	742	284	154	125	29	36
11	......	707	341	186	64	23	26	850	233	175	125	29	36
12	434	672	402	186	64	18	27	850	233	175	108	36	36
13	467	637	418	186	64	18	28	850	271	175	108	36	36
14	418	568	402	186	36	16	29	814	284	175	92	18	36
15	402	500	371	186	29	14	30	602	298	164	92	16	30
							31	......	312	......	77	14	......

NOTE.—Observer's report on operation of canals diverting above gage. Canals dry until June 7, 1916.

June 7, 2 canals carrying water.
June 8, 3 canals carrying water.
12, canals dry.
19, 3 canals carrying water.
22, 2 canals carrying water.
26, canals dry.
July 3, 3 canals carrying water.
10, canals dry.
17, 2 canals carrying water.
July 24, canals dry.
31, 2 canals carrying water.
Aug. 7, canals dry.
14, 3 canals carrying water.
16, canals dry.
28, 3 canals carrying water.
Sept. 3, canals dry.
11, 3 canals carrying water.
18, canals dry.

Monthly discharge of West Fork of Carson River at Woodfords, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 12-30	850	326	554	20,900
May	1,069	233	555	34,100
June	534	144	306	18,200
July	186	77	145	8,920
August	77	14	47.4	2,910
September	36	11	25.3	1,510
The period	1,069	11	254	86,500

HUMBOLDT RIVER BASIN.

HUMBOLDT RIVER AT PALISADE, NEV.

LOCATION.—In sec. 36, T. 32 N., R. 51 E., at highway bridge at Palisade, Eureka County, 100 feet below Southern Pacific Railroad bridge and about a mile above mouth of Pine Creek.

DRAINAGE AREA.—5,010 square miles.

RECORDS AVAILABLE.—November 27, 1902, to October 19, 1906; July 26, 1911, to September 30, 1916.

GAGE.—Chain gage at highway bridge December 1, 1911, to September 30, 1916; read by Albina Siri; datum same as that of inclined staff on left bank near Southern Pacific Railroad bridge, read from July 26 to November 30, 1911. Original gage was a vertical staff on right abutment of the highway bridge which was destroyed by high water in 1910. No determined relation between the original and present datum.

DISCHARGE MEASUREMENTS.—Made from cable about an eighth of a mile above gage or by wading.

Channel and control.—Bed composed of sand and gravel. Control at low stages is a gravel bar 50 to 75 feet below gage; at high stages a pile bent railroad bridge about 300 feet below gage and a rock riffle a few hundred feet farther downstream become effective; both fairly permanent. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 5.54 feet at 2 p. m. March 21 (discharge, 1,810 second-feet); minimum stage, 1.01 feet at 2.10 p. m. October 9 (discharge, 17 second-feet).

1903–1906, 1911–1916: Maximum stage recorded, 7.5 feet January 25, 1914 (discharge, 2.780 second-feet); minimum stage, 0.96 foot, August 28 to September 1, 1915 (discharge, 12 second-feet).

Ice.—Stage-discharge relation slightly affected by ice.

Diversions.—Some water diverted for irrigation in valley above canyon.

Regulation.—Flow affected by irrigation diversions above.

Accuracy.—Stage-discharge relation fairly permanent; affected by ice December 29 to January 5, January 18–24, January 30 to February 2. Rating curve well defined between 0 and 2,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Humboldt River at Palisade, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 15[a]	A. B. Purton	1.33	37.3	Mar. 22	L. W. Jordan	5.21	1,580
Jan. 8	L. W. Jordan	[b] 1.71	80	May 13	.....do	3.74	713
Mar. 9	.....do	2.62	292	June 5	.....do	3.02	413
10	.....do	2.72	316	Aug. 14	.....do	1.22	32.2

[a] Point of zero flow determined at gage height 0.4±.2. [b] Slight effect from ice.

Daily discharge, in second-feet, of Humboldt River at Palisade, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	19	36	81			275	1,300	889	553	407	66	23
2	21	36	84			258	1,430	889	513	407	60	23
3	21	36	86		84	242	1,360	889	475	390	53	33
4	21	38	89		86	227	1,360	835	440	374	48	23
5	17	38	89		92	242	1,300	889	407	374	44	22
6	20	38	89	84	95	275	1,360	889	407	341	42	22
7	20	38	86	64	98	275	1,360	889	374	324	41	22
8	17	39	86	77	98	275	1,360	835	374	308	39	21
9	17	39	86	81	101	275	1,360	783	390	308	38	21
10	18	41	86	81	118	341	1,360	733	475	292	36	21
11	18	41	86	74	107	390	1,360	733	513	275	35	21
12	18	42	86	79	98	440	1,430	733	553	258	33	25
13	18	42	86	89	92	475	1,360	685	553	242	32	28
14	18	41	104	84	98	553	1,360	685	553	212	30	28
15	21	39	96	76	107	595	1,360	685	595	212	29	28
16	21	39	84	69	121	639	1,360	685	639	185	28	26
17	28	39	70	55	140	639	1,360	639	639	173	26	26
18	29	41	62		140	835	1,360	639	685	161	26	25
19	29	41	62		150	1,150	1,360	595	685	150	25	25
20	30	41	62		161	1,460	1,300	595	685	140	25	25
21	30	42	64		161	1,780	1,240	595	685	140	25	26
22	30	44	69		173	1,780	1,240	513	685	130	23	26
23	32	49	74		185	1,640	1,180	475	639	121	23	29
24	32	53	79		198	1,640	1,120	475	639	118	23	29
25	33	57	98	81	212	1,640	1,060	513	595	111	22	28
26	33	62	95	81	227	1,640	1,000	513	553	101	22	26
27	33	66	92	81	227	1,640	1,000	475	513	95	22	26
28	35	66	86	74	242	1,570	1,000	513	513	86	21	26
29	35	71		71	275	1,570	945	513	475	81	25	25
30	35	76				1,360	945	553	440	76	25	25
31	35					1,360		595		71	25	

Note.—Discharge estimated, on account of ice, Dec. 29 to Jan. 5, 80 second-feet; Jan. 18-23, 50 second-feet; Jan. 24, 70 second-feet; Jan. 30 to Feb. 2, 75 second-feet. Discharge interpolated Mar. 19 and 20.

Monthly discharge of Humboldt River at Palisade, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	35	17	25.3	1,560
November	76	36	45.7	2,720
December	104	62	82.5	5,070
January	89	....	71.3	4,380
February	275	....	139	8,000
March	1,780	227	886	54,500
April	1,430	945	1,260	75,000
May	889	475	675	41,500
June	635	374	542	32,300
July	407	71	215	13,200
August	66	21	32.6	2,000
September	29	21	24.8	1,480
The year	1,780	17	333	242,000

HUMBOLDT RIVER NEAR GOLCONDA, NEV.

Location.—In sec. 21, T. 36 N., R. 40 E., at highway bridge about 1¼ miles northwest of Golconda, Humboldt County, and about 12 miles above mouth of Little Humboldt River.

Drainage area.—10,800 square miles.

Records available.—October 24, 1894, to December 31, 1909; September 8, 1910, to September 30, 1916.

Gage.—Chain gage on downstream side of bridge near right bank, installed November 5, 1910; read by Florence Bernard. Several gages at various datums and at various sites used prior to this date.

Discharge measurements.—Made from highway bridge at gage or by wading.

Channel and control.—Bed composed of loose sand; shifts occasionally. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 8.7 feet at 2.40 p. m. April 23 and 10 a. m. April 24 (discharge, 1,320 second-feet); minimum stage, 1.8 feet Octber 1-23 (discharge, 0.4 second-foot).

1900-1916: Maximum stage recorded, 16.6 feet April 3, 5, 6, 8, 10, 13, 15, 17, 20, 22, 24, 27, 29, and May 1, 1907 (discharge, 3,160 second-feet); minimum stage, 2.7 feet January 2, 4, 6, 9, 10, 11, and 17, 1906 (discharge, zero).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Considerable water is diverted above the station.

Regulation.—Low water flow regulated by following diversion dams, which provide practically no storage: Bernard's dam, rock and brush, half a mile above gage; Anderson's dam, rock and brush, 1½ miles above; Taylor and Sheehan dam, concrete spillway with flashboards, small power plant which develops power for pumping into high-line canal; Pinson's dam, rock and brush, about 5 miles above gage.

Accuracy.—Stage-discharge relation not permanent; affected by ice. Rating curves fairly well defined for ranges of stage used. Chain gage read once each day to hundredths. Daily discharge ascertained by applying daily gage height to rating tables, except November 17-30 and May 24 to June 8, when shifting-control method was used, and for periods when stage-discharge relation was affected by ice, as given in footnote to daily discharge table.

Discharge measurements of Humboldt River near Golconda, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16[a]	A. B. Purton	1.90	1.2	May 11	L. W. Jordan	6.56	649
Jan. 9	L. W. Jordan	[b] 2.70	33.2	June 13	do	3.20	66
Mar. 10	do	4.80	298	Aug. 21	do	2.40	20.8
20	do	6.61	667				

[a] Point of zero flow determined at gage height 1.6±0.1.
[b] Shore ice at gage; control partly open.

Daily discharge, in second-feet, of Humboldt River near Golconda, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.4	0.7	32	24		231	935	1,220	227	9	53	25
2	.4	.7	32	25		238	995	1,150	211	9	53	25
3	.4	.7	32	26		252	1,030	1,120	208	9	53	25
4	.4	.7	32	29		252	1,090	1,060	168	9	53	25
5	.4	.7	32	32		252	1,120	1,030	134	13	53	25
6	.4	.7	32	36		252	1,150	1,030	115	13	74	25
7	.4	.7	32	45		267	1,220	995	95	13	74	25
8	.4	.7	29	40		283	1,250	965	84	13	74	25
9	.4	.7	29	33		283	1,250	935	74	9	74	25
10	.4	.7	29		137	283	1,250	905	74	13	74	21
11	.4	.7	29		130	283	1,280	624	74	17	74	21
12	.4	.7	29		122	283	1,280	624	74	53	74	17
13	.4	.7	29		142	283	1,280	624	70	53	41	17
14	.4	.7	29		152	275	1,280	547	70	60	35	17
15	.4	.7	29		163	267	1,280	476	67	60	25	17
16	.4	.7	29		174	252	1,280	391	67	60	25	17
17	.4	1.5	28		198	252	1,280	391	47	60	21	13
18	.4	2	27		198	252	1,280	432	47	60	21	13
19	.4	3	26		198	391	1,280	476	35	74	17	13
20	.4	4	26		224	678	1,280	476	25	74	21	13
21	.4	5	26		283	678	1,280	476	25	74	21	13
22	.4	6	26		238	678	1,280	476	21	74	21	13
23	.4	8	26		211	678	1,320	523	21	74	25	13
24	.7	9	26		211	678	1,320	450	21	67	25	6
25	.7	10	26		211	733	1,280	383	17	67	25	6
26	.7	12			211	789	1,280	341	17	67	25	6
27	.7	14			218	789	1,280	320	13	74	25	6
28	.7	21			224	847	1,250	316	13	74	25	6
29	.7	23			224	876	1,250	313	9	74	25	6
30	.7	29				876	1,220	277	9	53	25	6
31	.7					905		258		53	25	

NOTE.—Mean discharge estimated on account of ice as follows: Dec. 26–31 and Jan. 10–22, 25 second-feet; an. 23–31, 35 second-feet; Feb. 1–9, 100 second-feet.

Monthly discharge of Humboldt River near Golconda, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0.7	0.4	0.477	29.3
November	29	.7	5.29	315
December	32		28.1	1,730
January			30.0	1,840
February	283		164	9,430
March	905	231	462	28,400
April	1,320	935	1,230	73,200
May	1,220	258	632	38,900
June	227	9	71.1	4,230
July	74	9	46.2	2,840
August	74	17	40.5	2,490
September	25	6	16.2	964
The year	1,320	.4	226	164,000

HUMBOLDT RIVER NEAR OREANA, NEV.

Location.—In sec. 35, T. 29 N., R. 32 E., 2 miles above highway bridge near J. J. McCarthy's ranch and 2 miles southwest of Oreana, Humboldt County (railroad station called Nenzel).

Drainage area.—About 13,800 square miles (measured on map issued by General Land Office).

Records available.—January 27, 1896, to December 31, 1909; September 7, 1910, to September 30, 1916.

Gage.—Friez water-stage recorder on right bank February 24 to August 22, 1914, and October 4, 1914, to September 30, 1916; inspected by Nora McCarthy. Original gage, vertical staff nailed to the right abutment of the old highway bridge, was installed January 27, 1896, and was washed out May 26, 1897. A temporary gage was used until September 7, 1897; September 8 a new inclined staff gage was installed on the left bank about 1½ miles above the old bridge and opposite the railroad section house. This gage was washed out in 1902. A vertical staff gage fastened to piling of old Lovelocks Valley dam, at the same datum and presumably at the same site as the inclined gage, was read from November 29, 1902, until December 31, 1909, when station was discontinued. The datum was lowered 2.0 feet October 1, 1904. Station was reestablished September 7, 1910, a temporary gage, at a new datum, 150 feet above the bridge, being used until November 9, 1910; then a permanent vertical staff gage was installed at the highway bridge, which was read November 9, 1910, to February 23, 1914, and August 23 to October 3, 1914.

Discharge measurements.—Made from cable 20 feet below gage or by wading.

Channel and control.—Bed composed of sand; principal control not well defined, but is probably about half a mile below gage, where bed is composed of firm clay; fairly permanent; low-water control is about 50 feet below gage. Right bank high and comparatively clean; left bank not likely to overflow, but subject to caving. Point of zero flow about at gage height 0.3 foot.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 4.44 feet at 2 p. m May 2 (discharge, 793 second-feet; minimum stage from water-stage recorder, 0.50 foot on October 2 (discharge, 2.6 second-feet).

1896–1916: Maximum stage recorded, 12.0 feet May 12, 1897 (discharge, 3,050 second-feet); minimum stage, river dry in June and July, 1905, and in August and September, 1915.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Station is above all diversions for the Lovelocks district, but considerable water is diverted above the station for direct irrigation and storage.

Regulation.—Flow is affected by water stored and released by the Humboldt-Lovelocks Irrigation, Light & Power Co., at its reservoirs a few miles up the river, near Humboldt.

Accuracy.—Stage-discharge relation fairly permanent at higher stages, but not at extremely low stages, when stream flows through winding channel in shifting sand bed of river; affected by ice December 16 to February 20. Rating curve used October 29 to August 16 well defined between 10 and 800 second-feet; curves used October 1–19 and August 20 to September 30, not well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting recorder graph, except for periods during which stage-discharge relation was affected by ice or by shifting control; ascertained by shifting-control method October 20–28, and August 17–19; interpolated on days for which gage record is missing. Records obtained by use of rating tables good; others fair.

Discharge measurements of Humboldt River near Oreana, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	A. B. Purton	0.93	24.2	May 10	L. W. Jordan	3.74	602
Dec. 19[a]	L. W. Jordan	1.18	13.8	June 12	....do	1.71	132
Jan. 15[b]	....do	1.46	24.7	Aug. 21	....do	0.98	20.3
Mar. 20	....do	1.45	82				

[a] Complete ice cover, 0.10 foot thick; mush ice underneath.
[b] Complete ice cover 0.80 foot thick; mush ice underneath.

Daily discharge, in second-feet, of Humboldt River near Oreana, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	Junc.	July.	Aug.	Sept.
1	3.0	11	23	......	119	277	760	335	62	196	20
2	2.6	12	26	......	123	284	788	293	59	194	23
3	3.6	12	24	......	115	323	776	268	57	154	22
4	4.0	12	25	......	102	398	740	230	54	100	20
5	4.3	12	26	......	85	396	691	204	52	82	19
6	4.0	12	26	......	71	400	672	180	70	74	19
7	4.3	12	26	......	62	459	650	182	115	71	20
8	4.6	12	28	......	57	550	626	202	121	68	20
9	5.8	12	27	......	52	583	615	186	123	65	20
10	7.4	14	28	......	47	607	599	159	128	87	18
11	7.8	14	27	......	44	645	556	144	146	87	17
12	7.8	16	26	......	41	661	456	130	156	83	16
13	8.6	17	26	......	79	677	459	121	169	80	14
14	9.4	19	30	......	171	691	464	148	176	78	14
15	9.4	28	26	......	114	702	438	174	173	76	12
16	9.4	23	......	......	87	712	436	169	177	72	12
17	9.4	18	......	......	80	726	436	157	182	54	12
18	9.8	19	......	......	79	734	428	150	186	32	12
19	9.8	22	......	......	80	746	408	146	191	26	12
20	9.8	21	......	......	121	760	436	148	195	21	14
21	9.4	21	......	124	281	768	430	148	200	20	15
22	9.0	22	......	128	321	737	413	119	204	20	18
23	9.4	21	......	123	333	762	359	90	212	19	18
24	9.4	22	......	123	358	765	318	80	212	18	17
25	9.8	21	......	124	383	762	270	76	194	19	17
26	9.8	20	......	137	340	740	210	72	180	19	17
27	10	22	......	130	306	734	212	68	176	18	16
28	10	22	......	128	288	712	264	68	174	18	16
29	11	24	......	124	273	677	459	65	174	18	16
30	11	24	......	......	266	683	441	64	186	18	17
31	11	......	......	......	264	......	398	......	196	18	......

NOTE.—Mean discharge estimated on account of ice as follows: Dec. 16–31, 12 second-feet; Jan. 1–31, 17 second-feet; Feb. 1–20, 85 second-feet. Discharge interpolated July 16–21 and Aug. 13–14.

Monthly discharge of Humboldt River near Oreana, Nev., for year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	11	2.6	7.89	485
November	28	11	17.9	1,070
December	30		18.9	1,160
January			17.0	1,050
February	137		98.0	5,640
March	383	41	166	10,200
April	768	277	622	37,000
May	788	210	491	30,200
June	335	64	153	9,100
July	212	52	152	9,350
August	196	18	61.5	3,780
September	23	12	16.8	1,000
The year	788	2.6	151	110,000

HUMBOLDT RIVER NEAR LOVELOCKS, NEV.

Location.—In NW. ¼ sec. 11, T. 25 N., R. 31 E., 1,500 feet below dam and reservoir on Big 5 ranch, lowest diversion for irrigation on Humboldt River, and 9 miles south of Lovelocks, Humboldt County.

Drainage area.—14,200 square miles.

Records available.—February 7, 1912, to September 30, 1916.

Gage.—Lietz water-stage recorder on left bank on the opposite side of the river and a few feet downstream from inclined gage to which it is referred; inspected by V. A. Westfall. Original inclined staff gage on right bank was read February 7 to June 17, 1912, when Lietz gage was installed a few feet below it; Lietz gage washed out June 18, 1914, and was replaced on left bank June 26, 1914.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Bed is composed of firm clay. Control fairly permanent. One channel at all stages. Stage of zero flow, determined by measurement June 11, 1916, gage height −0.5+0.1 foot.

Extremes of discharge.—Maximum stage for year, from water-stage recorder, 1.29 feet at 2 p. m. March 17 (discharge, 257 second-feet); minimum stage, channel dry May to September.

1912–1916: Maximum stage recorded, 5.15 feet May 4, 1914 (discharge, 1,450 second-feet); minimum stage (channel dry during April, May, and June, 1913, and May to September, 1916).

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Below all irrigation diversions.

Regulation.—Flow affected by irrigation diversions and storage.

Accuracy.—Stage-discharge relation fairly permanent except at extreme low water; not affected by ice. Rating curve for 1915 fairly well defined between 0 and 250 second-feet was used, as no measurements were made during period of flow in 1916. Operation of water-stage recorder satisfactory except for breaks in record as shown in footnote to daily-discharge table. Daily discharge determined by applying to rating table mean daily gage height obtained by inspecting recorder graph. Records fair for period of flow during February and March.

The following discharge measurement was made by A. B. Purton:

November 17, 1915: Gage height, −0.01 foot; discharge (estimated), 0.10 second-feet.

Daily discharge, in second-feet, of Humboldt River near Lovelocks, Nev., for the year ending, Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.4	0.1	0.1	0.1	....	6	0.1
2	.5	.1	.1	.1	....	6	.1
3	.1	.1	.1	.1	....	6	.1
4	.1	.1	.1	.1	....	6	.1
5	.1	.1	.1	.1	48	9	.1
6	.1	.1	.1	.1	....	10	.1
7	.1	.1	.2	.1	....	....	.1
8	.1	.1	.2	.1	....	....	.1
9	.1	.1	.3	.1	....	....	.1
10	.2	.1	.3	.1	....	....	.1
11	.2	.1	.4	.1	....	25	.1
12	.2	.1	.4	.1	41	20	.1
13	.2	.1	.4	.1	41	16	.1
14	.2	.1	.3	.1	48	13	.1
15	.2	.1	.3	.1	54	13	.1
16	.2	.1	.2	.1	92	13	.1
17	.1	.1	.2	.1	114	119	.1
18	.1	.1	.1	.1	106	.6	.1
19	.1	.1	.1	.1	109	.4	.1
20	.1	.1	.1	.1	109	.4	.1
21	.1	.1	.1	.1	146	.4	.1
22	.1	.1	.1	.2	167	.4	.1
23	.1	.1	.1	.2	....	.4	.1
24	.1	.1	.1	.2	....	.2	.1
25	.1	.1	.1	.2	....	.1	.1
26	.1	.1	.1	.2	58	.1	.1
27	.1	.1	.1	.2	47	.1	.1
28	.1	.1	.1	.2	36	.1	.1
29	.1	.1	.1	.2	20	.1	.1
30	.1	.1	.1	.2	....	.1	.1
31	.1	....	.1	.2	....	.1	....

NOTE.—Mean discharge interpolated on account of breaks in recording-gage record as follows: Feb. 1-4, 24 second-feet; Feb. 6-11, 44 second-feet; Feb. 23-25, 112 second-feet; Mar. 7-10, 18 second-feet. River was dry on June 11, water standing in pools, and has been assumed so from May 1 to Sept. 30.

Monthly discharge of Humboldt River near Lovelocks, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0.5	0.1	0.145	9
November	.1	.1	.100	6
December	.4	.1	.168	10
January	.2	.1	.132	8
February	167	....	66.6	3,830
March	119	.1	10.9	670
April	.1	.1	.100	6
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
The year	167	0	6.25	4,540

STARR CREEK NEAR DEETH, NEV.

Location.—In NE. ¼ sec. 12, T. 36 N., R. 59 E., at highway bridge, 2 miles above mouth and about 3 miles southeast of Deeth, Elko County; below all large tributaries except Boulder Creek.

Drainage area.—Not measured.

Records available.—June 4, 1913, to September 30, 1916.

Gage.—Vertical staff nailed to upstream pile of bridge bent near right bank; read by G. E. Weathers. Datum of gage raised 1.00 foot August 23, 1916.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of small gravel. Control is gravel bar; shifts occasionally. One channel except at extremely high stages, when part of the flow passes under an auxiliary bridge.

Extremes of discharge.—Maximum stage recorded during year, 4.05 feet June 17 and 18 (discharge, 126 second-feet); minimum stage, 1.42 feet August 23 to September 1 and September 6 (discharge, 1.3 second-feet).

1913–1916: Maximum stage recorded, 5.6 feet June 4, 1914 (discharge, 372 second-feet); minimum stage, 1.42 feet August 23 to September 1 and September 6, 1916 (discharge, 1.3 second-feet).

Ice.—Stage-discharge relation slightly affected by ice.

Diversions.—Station is below practically all diversions from Starr Creek.

Regulation.—Some variation in daily flow at times caused by diversions for irrigation.

Accuracy.—Stage-discharge relation permanent; affected by ice November 14, December 29 to January 10, and January 14 to February 6. Rating curve well defined between 0 and 150 second-feet. Gage read to quarter-tenths three or four times a week. Daily discharge determined by applying daily gage height to rating table and by interpolation for days when gage was not read, except during period affected by ice, when it was estimated from observer's notes, weather records, and two discharge measurements. Records fair.

Discharge measurements of Starr Creek near Deeth, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14[a]	A. B. Purton	2.75	9.1	June 20	L. W. Jordan	3.93	112
Jan. 6[a]	L. W. Jordan	2.81	8.0	Aug. 23	do	[b] 2.42	1.3
May 1	do	2.87	15.9				

[a] Frozen over at gage; control about half open.

[b] Gage height referred to new datum, 1.42 feet.

Daily discharge, in second-feet, of Starr Creek near Deeth, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.8	6.4	8.0	......	......	11	34	16	16	55	3.6	1.3
2	4.8	6.4	8.0	......	......	10	32	15	17	60	3.6	1.5
3	4.8	6.4	8.0	......	......	10	30	14	17	60	3.6	1.7
4	4.8	6.4	8.0	......	......	10	30	16	17	55	3.6	1.6
5	4.8	6.4	8.0	......	......	10	30	17	18	50	3.6	1.4
6	4.8	6.4	8.0	8	......	10	32	17	20	46	3.6	1.3
7	4.8	6.4	8.0	......	8	11	31	17	34	44	2.4	4.8
8	4.8	6.4	8.0	......	9	12	30	17	55	42	2.4	4.3
9	4.8	6.4	8.0	......	10	14	26	17	70	42	2.4	4.3
10	4.8	6.4	8.0	......	11	34	26	17	85	39	2.4	4.6
11	4.8	6.4	8.0	6.4	12	42	28	16	85	36	2.4	4.8
12	4.8	6.4	8.0	6.4	11	50	30	14	90	34	2.4	4.8
13	4.8	6.4	8.0	6.4	10	50	30	14	96	30	4.8	4.8
14	4.8	9.1	7.7	......	10	50	30	14	102	26	4.8	4.8
15	4.8	8.2	7.4	......	10	46	30	14	108	22	4.8	4.8
16	6.4	7.4	7.4	......	10	46	30	14	117	18	4.8	4.8
17	6.4	7.4	7.4	......	10	46	30	12	126	14	4.8	4.8
18	6.4	7.4	7.4	......	10	48	30	12	126	14	4.8	4.8
19	6.4	7.4	7.4	......	10	50	30	12	120	14	4.8	4.8
20	6.4	7.4	7.7	......	10	52	28	12	114	13	4.8	4.8
21	6.4	7.4	8.0	......	16	55	26	12	74	12	4.8	4.8
22	6.4	8.0	9.0	......	23	60	26	12	69	12	4.8	4.8
23	6.4	8.0	10.0	......	22	53	26	12	64	12	1.3	4.8
24	6.4	8.0	8.0	......	20	46	26	20	60	12	1.3	4.8
25	6.4	8.0	8.0	......	17	43	24	80	60	12	1.3	4.8
26	6.4	8.0	8.0	......	14	40	23	53	58	12	1.3	4.8
27	6.4	8.0	8.0	......	14	38	23	26	55	12	1.3	4.8
28	6.4	8.0	8.0	......	13	36	23	23	55	12	1.3	4.8
29	6.4	8.0	......	......	12	34	23	18	55	12	1.3	4.8
30	6.4	8.0	......	......	......	34	20	14	55	12	1.3	4.8
31	6.4	......	......	......	......	34	......	14	......	7.8	1.3	......

NOTE.—Mean discharge estimated, on account of ice, as follows: Dec. 29 to Jan. 5, 8 second-feet; Jan. 7–10, 7 second-feet; Jan. 14-31, 5 second-feet; Feb. 1-6, 6 second-feet.

Monthly discharge of Starr Creek near Deeth, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	6.4	4.8	5.63	346
November	9.1	6.4	7.23	430
December	10	7.4	7.98	491
January	......	......	5.97	367
February	23	......	11.3	650
March	60	10	35.0	2,150
April	34	20	27.9	1,660
May	80	12	18.7	1,150
June	126	16	67.9	4,040
July	60	7.8	27.2	1,670
August	4.8	1.3	3.09	190
September	4.8	1.3	4.09	243
The year	126	1.3	18.5	13,400

MARYS RIVER NEAR DEETH, NEV.

LOCATION.—In NW. ¼ sec. 31, T. 40 N., R. 60 E., at bridge 300 feet east of Mala Vista ranch house of Nevada Land & Livestock Co., and 20 miles north of Deeth, Elko County.

DRAINAGE AREA.—355 square miles (measured on map of Nevada issued by General Land Office, edition of 1908).

RECORDS AVAILABLE.—November 24, 1902, to July 14, 1903; January 17, 1912, to September 30, 1916.

GAGE.—Chain gage on upstream side of bridge; read by Jess Larson. Original staff gage at same bridge, but with different datum, read November 24, 1902, to July 14, 1903.

DISCHARGE MEASUREMENTS.—Made from bridge at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and loose sand; banks below gage subject to caving; control slightly shifting. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.0 feet April 13-15 (discharge, 381 second-feet); minimum stage, 2.24 feet September 26-30 (discharge 1.4 second-feet).

1902-03, 1912-1916: Maximum stage recorded, 6.3 feet May 19 and June 3-7, 1912 (dischage, 439 second-feet); minimum stage, 2.24 feet September 26-30, 1916 (discharge, 1.4 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Station is below all diversions except one small ditch on the Mala Vista ranch and the Cross ranch diversions about 14 miles below.

REGULATION.—During low water periods flow is affected by diversion dams above.

ACCURACY.—Stage-discharge relation changed slightly during winter; affected by ice December 16 to February 17 and February 27 to March 11. Rating curve used October 1 to December 15 well defined for range of stage during period; that used February 18 to September 30 well defined below 250 second-feet and poorly defined above. Gage read to even-numbered hundredths once daily. Daily discharge determined by applying daily gage height to rating tables. Records good except for high stages for which the rating curve is poorly defined.

Discharge measurements of Marys River near Deeth, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13[a]	A. B. Purton	2.46	8.8	June 19	L. W. Jordan	4.30	152
Jan. 5[b]	L. W. Jordan	3.40	12.0	Aug. 23	.....do	2.34	2.9
May 2	.....do	4.82	217				

[a] Shore ice. [b] Frozen over; water 0.2 feet deep on top of ice.

Daily discharge, in second-feet, of Marys River near Deeth, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	11	14	......	......	189	236	111	42	7.3	2.5
2	1.5	11	15	......	......	241	217	111	42	7.3	2.5
3	1.5	11	15	......	......	254	233	111	41	6.6	2.5
4	1.5	11	15	......	......	254	250	111	40	6.6	2.5
5	1.5	11	15	......	......	267	267	121	39	6.6	2.5
6	1.5	11	15	......	......	267	281	131	37	5.9	2.0
7	1.5	11	15	......	......	267	309	142	36	5.2	2.0
8	1.5	11	15	......	......	267	309	153	35	5.2	2.0
9	1.5	11	15	......	......	281	309	177	34	4.5	2.0
10	3	11	15	......	......	295	309	189	41	4.5	2.0
11	3	11	15	......	......	309	281	202	41	4	2.0
12	5	11	15	......	57	323	267	202	39	4	2.0
13	5	10	16	......	72	381	267	177	38	4	2.0
14	5	10	16	......	86	381	189	165	34	4	2.0
15	8	9.8	16	......	101	381	165	165	33	4	2.0
16	8	9.8	......	......	118	337	131	165	33	4	2.0
17	8	10	......	......	135	309	131	165	33	4	1.8
18	8	10	......	23	153	309	131	165	31	3.5	1.8
19	8	10	......	24	171	309	131	153	30	3.5	1.8
20	8	11	......	24	189	295	131	142	30	3.5	1.8
21	8	12	......	25	202	254	131	131	29	3.5	1.8
22	8	12	......	27	215	241	131	131	28	3	1.8
23	8	12	......	29	215	228	142	121	27	3	1.8
24	8	13	......	31	215	228	142	111	24	3	1.6
25	8	13	......	33	202	241	131	54	22	3	1.6
26	8	13	......	35	177	254	121	52	18	2.5	1.4
27	8	13	......	......	165	254	111	52	16	2.5	1.4
28	8	14	......	......	189	254	111	46	14	2.5	1.4
29	8	14	......	......	189	254	111	45	11	2.5	1.4
30	8	14	......	......	189	254	111	45	10	3	1.4
31	8	......	......	......	189	......	111	......	8.8	2.5	......

NOTE.—Mean discharge estimated on account of ice as follows: Dec. 16–31, 13 second-feet; Jan. 1–31, 12 second-feet; Feb. 1–17, 15 second-feet, 27–29, 40 second-feet; Mar. 1–11, 50 second-feet. Discharge interpolated Oct. 1–2, Nov. 19, 21–23, 25, 27–28, Dec. 1–2, 4, 6–7, 9, 11–13, Mar. 13–14, 16–17, 19, 21, May 1–4, July 4–8.

Monthly discharge of Marys River near Deeth, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	8	1.5	5.50	338
November	14	9.8	11.4	678
December	16	....	14.0	861
January	....	....	12.0	738
February	....	....	21.6	1,240
March	215	....	122	7,500
April	381	189	279	16,600
May	309	111	190	11,700
June	202	45	128	7,620
July	42	8.8	30.2	1,860
August	7.3	2.5	4.17	256
September	2.5	1.4	1.91	114
The year	381	1.4	68.2	49,500

LAMOILLE CREEK NEAR LAMOILLE, NEV.

Location.—In sec. 6, T. 32 N., R. 58 E., about 50 feet below tailrace of Elko-Lamoille Power Co.'s plant, 50 feet above first irrigation diversion, about 2 miles above Lamoille and 22 miles southeast of Elko, Elko County.

Drainage area.—About 14 square miles (measured on maps issued by United States Forest Service).

Records available.—May 8, 1915, to September 30, 1916.

Gage.—Vertical staff on left bank, read by E. Galloway.

Discharge measurements.—Made from cable, footbridge at gage, or by wading.

Channel and control.—Bed composed of gravel and large boulders. Control shifts at extremely high water. One channel at all stages.

Extremes of discharge.—1915–16: Maximum stage recorded during year, 2.06 foot at 7 p. m. June 17, 1916 (discharge, 330 second-feet); minimum stage, 0.48 foot December 29, 1915, and January 20 and 21, 1916 (discharge, 2 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—Above all irrigation diversions. Water is diverted for Elko-Lamoille Power Co. plant, but returned to stream about 50 feet above gage.

Regulation.—A daily fluctuation occurs on days when power plant is not in continuous operation.

Accuracy.—Stage-discharge relation changed during high water in June: not seriously affected by ice. Rating curves well defined between 0 and 250 second-feet. Gage read to hundredths twice daily. On days when power plant is operated part time mean gage height determined by weighting readings. Daily discharge determined by applying mean daily gage height to rating tables; interpolated for days when stage-discharge relation was affected by ice. Shifting-control method used June 3–16. Records good.

Discharge measurements of Lamoille Creek near Lamoille, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 10[a]	A. B. Purton	0.52	2.7	Apr. 18	L. W. Jordan	1.00	34.2
Jan. 4[b]	L. W. Jordan	.56	3.4	June 28	.....do	1.93	253
Mar. 23	.....do	.87	21.3	Sept. 3	.....do	.90	9.3

[a] Zero flow estimated at gage height 0.2±.1.

[b] Frozen over at gage; riffle open.

Daily discharge, in second-feet, of Lamoille Creek near Lamoille, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.5	3.5	3.2		2.9	5.5	20	74	79	201	46	11
2	3.5	2.9	3.2		2.9	5.5	21	77	84	179	44	10
3	3.8	2.9	3.2		2.9	6.4	20	95	95	142	41	10
4	4.2	3.5	3.5		2.7	6.4	21	116	122	156	38	10
5	4.2	3.5	3.5		2.5	6.4	21	125	168	175	36	10
6	4.2	3.5	3.5		2.4	9.1	21	146	190	183	33	8.4
7	4.2	3.5	3.5	2.9	2.2	7.3	20	128	208	175	31	9.2
8	4.2	3.5	3.5	2.9	2.2	6.4	21	146	234	211	31	8.4
9	4.2	3.8	3.5	2.9	2.2	6.8	21	132	234	183	28	7.9
10	4.2	3.5	3.5	2.9	2.2	8.2	24	125	239	164	27	8.4
11	4.2	3.6	3.2	2.5	2.2	8.2	27	119	224	148	24	8.4
12	4.2	3.8	3.0	3.0	2.1	8.2	26	108	199	142	22	7.4
13	4.2	3.5	2.9	3.5	2.2	11	26	99	218	138	22	7.4
14	4.2		2.5	3.5	2.3	11	26	90	224	122	20	6.9
15	4.5			3.5	2.5	11	28	90	224	111	19	7.4
16	4.2			2.9	2.7	12	30	95	224	122	18	6.4
17	4.5			2.7	2.9	13	32	95	259	116	18	6.4
18	4.2	3.5	2.5	2.5	5.5	15	34	97	259	90	16	6.4
19	4.2	3.8	2.5	2.2	3.5	15	34	97	230	86	15	6.4
20	4.2	3.8	3.5	2.0	3.2	19	32	86	187	84	15	6.4
21	4.2	3.8	3.2	2.0	5.5	19	32	86	148	82	14	7.4
22	4.5	3.8	3.5	2.1	6.4	19	34	81	122	82	13	7.4
23	5.5	3.8	3.8	2.2	5.5	22	35	77	132	73	12	8.4
24	7.3	3.8	3.4	2.2	7.3	20	44	77	148	66	11	7.4
25	6.8	3.8	2.9	2.2	5.5	19	54	74	168	77	12	7.4
26	4.8	3.8	4.2	2.2	5.5	19	67	72	187	59	11	6.4
27	3.5	3.7	4.2	2.5	3.5	20	74	68	225	52	11	7.4
28	4.2	3.6	4.2	2.6	7.8	20	81	70	225	49	12	6.9
29	3.5	3.5	2.0	2.8	5.5	20	74	77	211	46	14	6.4
30	3.5	3.2	2.2	2.9		20	72	81	187	45	13	8.4
31	3.5		2.9	2.9		20		81		46	12	

Note.—Discharge interpolated because of ice Nov. 11, 14–17, 3.5 second-feet; Nov. 24–25, 27–28, Dec. 1, 12, 15–17, 2.5 second-feet; Dec. 24, 27, Jan. 1–6, 3.0 second-feet; also interpolated for days when gage was not read during January and February. Discharge June 3–16 determined by shifting-control method.

Monthly discharge of Lamoille Creek near Lamoille, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	7.3	3.5	4.33	266
November	3.8	2.9	3.56	212
December	4.2	2.0	3.17	195
January	3.5	2.0	2.73	168
February	7.8	2.1	3.68	212
March	22	5.5	13.2	812
April	81	20	35.7	2,120
May	146	68	96.3	5,920
June	259	79	188	11,200
July	211	45	116	7,130
August	46	11	21.9	1,350
September	11	6.4	7.88	469
The year	259	2.0	41.4	30,100

LAMOILLE CREEK NEAR HALLECK, NEV.

Location.—In NW. ¼ sec. 9, T. 35 N., R. 58 E., half a mile below mouth of Secret Creek, largest tributary, 1½ miles south of Halleck, Elko County, on Southern Pacific Railroad, and 2 miles above confluence with Humboldt River.

Drainage area.—245 square miles.

Records available.—May 12, 1913, to September 30, 1916.

Gage.—Vertical staff on left bank, 200 feet below ford, read by J. H. Lee and R. W. Randolph. Datum lowered 1.00 foot August 19, 1915.

Discharge measurements.—Made from cable 200 feet above gage or by wading.

Channel and control.—Bed composed of gravel. Control is gravel bar, which shifts occasionally and at times is affected by beaver dams. Channel very crooked; both banks overflowed during floods.

Extremes of discharge.—Maximum stage recorded during year, 5.92 feet March 8 (discharge, 201 second-feet); creek dry October 1–26 and August 6, to September 30.

1913–1916: Maximum stage recorded, 6.7 feet June 5, 1914 (discharge, 556 second-feet); minimum stage (creek dry in August and September, 1915, and in October, August and September, 1916).

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Below all diversions except one small ditch.

Regulation.—Flow affected by irrigation diversions above.

Accuracy.—Stage-discharge relation changed slightly during winter; affected by backwater from a beaver dam October 29, to December 31, and by ice December 13 to February 6. Rating curves fairly well defined for range in stage. Gage read to hundredths three times a week. Daily discharge determined by applying gage heights to rating tables and interpolating for days when gage was not read, except for periods when stage-discharge relation was affected. Records obtained by use of rating tables good; others fair.

Discharge measurements of Lamoille Creek near Halleck, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14[a]	A. B. Purton	3.77	3.0	May 2	L. W. Jordan	4.05	18.9
Jan. 5[b]	L. W. Jordan	4.24	11.4	June 19	do	5.80	183

[a] Frozen over at gage; riffle partly open. [b] Complete ice cover at gage; small channel open at riffle.

Daily discharge, in second-feet, of Lamoille Creek near Halleck, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1			10		170	66	19	19	89	2.2
2			10		172	62	19	18	91	1.6
3			11		185	58	20	18	88	1.0
4			11		198	56	21	17	84	.6
5			10		198	55	20	16	81	.1
6			10		198	55	20	18	81	
7			11	31	200	55	24	19	81	
8			11	31	201	56	27	37	61	
9			11	32	100	54	26	55	49	
10			11	34	174	53	25	63	37	
11			12	37	159	54	24	72	33	
12			11	39	121	55	22	81	29	
13				42	83	55	21	91	28	
14		5.6		46	78	55	21	101	27	
15		4.6		48	72	55	21	120	26	
16		4.6		49	77	48	23	139	24	
17		4.6		71	79	40	25	159	21	
18		5.8		110	81	40	26	172	20	
19		6.9		149	76	41	26	185	19	
20		6.9		152	72	40	27	176	18	
21		6.9		155	72	40	22	167	17	
22		6.9		152	72	33	16	159	16	
23		6.9		149	74	30	24	139	15	
24		15.0		162	76	27	33	119	14	
25		23.0		175	77	24	55	108	13	
26		10.0		188	74	21	56	97	12	
27	1.0	6.3		176	76	21	58	99	11	
28	2.0	6.3		164	75	21	45	101	10	
29	3.2	8.0		167	74	20	33	89	7.6	
30	3.2	9.8			74	20	21	89	5.2	
31	3.2				70		20		2.8	

NOTE.—Mean discharge estimated as follows: Nov. 1-13 on account of beaver dam, 4.4 second-feet; on account of ice Dec. 13-31, 10 second-feet; Jan. 1-31, 11 second-feet; Feb. 1-6, 12 second-feet. Zero discharge Oct. 1-26 and Aug. 6 to Sept. 30.

Monthly discharge of Lamoille Creek near Halleck, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3.2	0	0.41	25
November	23		6.51	387
December			10.3	633
January			11.0	676
February	188		83.8	4,820
March	201	70	116	7,130
April	66	20	43.7	2,600
May	58	16	27.1	1,670
June	185	16	91.4	5,440
July	91	2.8	35.8	2,200
August	2.2	0	.18	11
September	0	0	0	0
The year	201	0	32.5	25,600

NORTH FORK OF HUMBOLDT RIVER AT DEVILS GATE, NEAR HALLECK, NEV.

Location.—In sec. 13, T. 38 N., R. 57 E., at narrows about 3½ miles above buildings of Morgan Hill ranch (also known as Devils Gate ranch), 17 miles north of Halleck, Elko County, and 27 miles by wagon road from Elko.

Drainage area.—830 square miles (measured on General Land Office maps).

Records available.—November 11, 1913, to September 30, 1916; also at mouth of stream from October 10, 1902, to December 31, 1909, and October 1, 1910, to December 31, 1913.

Gage.—Stevens continuous water-stage recorder on right bank; inspected by John Taylor. Original gage was about 15 miles downstream, comparatively little run-off entering below the present station except during storms.

Discharge measurements.—Made from cable about 30 feet below gage or by wading.

Channel and control.—Bed composed of sand with gravel riffle at control; about half of the control section is affected by growth of moss. Channel crooked; banks comparatively high and covered with willows; at extremely high stages water may overflow right bank and pass in an overflow channel around gage. Gage height of zero flow, about 0.7 foot.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 7.05 feet at 5 p. m. April 3 (discharge, 632 second-feet); minimum stage, from water-stage recorder, 1.16 feet at 4 p. m. August 20 (discharge 5.4 second-feet).

1913–1916: Maximum stage recorded, 7.23 feet April 7, 1914 (discharge, 722 second-feet); minimum discharge, 1 second-foot August 20–28 and September 30, 1913 (stage, 2.5 feet).

Ice.—Stage-discharge relation seriously affected by ice; river freezes over at gage, but riffle is sometimes partly open; anchor ice collects on riffle.

Diversions.—Numerous diversions in the valley above and below the Devils Gate. During the summer almost all low-water flow is diverted.

Regulation.—Flow during summer depends on amount of irrigation above. A minimum flow is maintained from seepage and springs.

Accuracy.—Stage-discharge relation affected by moss on control during low water; fairly permanent at high stages; seriously affected by ice during winter. Rating curve used during October well defined between 0 and 250 second-feet; curves used remainder of year fairly well defined between 50 and 400 second-feet. Operation of water-stage recorder satisfactory except for breaks in record as shown in footnote to daily discharge table. Daily discharge ascertained by applying to rating tables, the mean daily gage height determined by inspecting recorder graph, except for periods when stage-discharge relation was affected by ice or shifting control. Records obtained by use of tables good; others fair.

Discharge measurements of North Fork of Humboldt River at Devils Gate near Halleck, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 13	A. B. Purton	[a] 1.87	17.7	May 1	L. W. Jordan	4.30	286
Jan. 6	L. W. Jordan	[b] 1.70	18.4	June 19	.....do	2.37	84
Mar. 25	.....do	[c] 5.23	384	Aug. 22	.....do	1.22	7.1

[a] Shore ice at control and anchor ice. Moss on riffle.
[b] Open channel in center. Shore ice both sides.
[c] Wire fence across stream 300 feet below collects drift.

Daily discharge, in second-feet, of North Fork of Humboldt River at Devils Gate near Halleck, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.0	13	18	....	381	285	118	57	16	11
2	5.8	14	20	....	483	273	110	60	14	10
3	5.8	14	21	....	600	256	108	63	14	9
4	5.9	15	22	....	600	250	104	66	13	9
5	6.0	16	21	....	574	244	97	77	11	9
6	6.3	16	21	....	522	266	93	70	11	9.4
7	6.3	17	21	....	444	256	90	63	11	9.8
8	6.3	17	21	....	405	250	95	60	11	9.4
9	6.3	18	20	....	431	244	93	55	10	9.4
10	6.7	18	20	....	483	239	95	51	10	9.8
11	7.1	18	20	....	561	228	96	42	10	9.8
12	7.5	19	16	....	613	217	100	37	10	10
13	7.9	18	20	....	496	206	102	35	10	11
14	8.3	18	24	....	405	195	102	34	10	11
15	8.7	18	....	....	405	184	95	30	9	11
16	9.1	18	....	....	393	173	93	31	9	11
17	9.5	18	....	....	381	162	90	33	7	11
18	9.5	18	....	....	369	152	86	30	6.6	10
19	9.0	18	....	....	357	147	84	27	5.8	10
20	9.0	20	....	....	333	142	89	26	5.8	10
21	9.0	20	....	....	321	142	108	24	5.8	11
22	10.0	20	....	....	303	132	124	23	7.4	11
23	10.0	20	....	....	291	128	126	24	7.8	11
24	9.0	20	....	470	285	132	116	24	8.2	12
25	10.0	20	....	405	291	157	103	25	8.2	12
26	12.0	20	....	393	303	195	92	24	8.6	11
27	11.0	19	....	381	315	222	82	24	8.6	11
28	10.0	18	....	431	315	206	74	22	8.6	11
29	12.0	19	....	509	315	168	66	20	9.0	11
30	12.0	19	....	470	297	139	59	19	9.8	11
31	12.0	....	....	381	....	126	....	18	11	....

NOTE.—Mean discharge estimated on account of ice and breaks in recording gage record from observer's notes, weather records, two discharge measurements, and comparison with record for Mary's River near Deeth, as follows: Dec. 15–31, 16 second-feet; Jan. 1–31, 15 second-feet; Feb. 1–19, 20 second-feet; Feb. 20 to Mar. 8, 30 second-feet; Mar. 9–20, 275 second-feet; Mar. 21–23, 525 second-feet. Discharge interpolated Oct. 10–16; determined by shifting-control method Nov. 1–12 and Aug. 1–20.

Monthly discharge of North Fork of Humboldt River near Halleck, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	12	5.8	8.52	524
November	....	13	17.9	1,070
December	24	....	18.0	1,110
January	....	....	15.0	922
February	....	....	23.4	1,350
March	....	....	276	17,000
April	613	285	409	24,300
May	285	126	197	12,100
June	126	59	96.3	5,730
July	77	18	38.5	2,370
August	16	5.8	9.59	590
September	12	9	10.4	619
The year	613	5.8	93.2	67,700

SOUTH FORK OF HUMBOLDT RIVER NEAR ELKO, NEV.

Location.—In sec. 19, T. 33 N., R. 55 E., at head of canyon below Cowling's ranch, 4 miles above mouth and 10 miles southwest of Elko, Elko County.

Drainage area.—Not measured (1,150 square miles at old station 1½ miles above).

Records available.—August 29, 1896, to December 31, 1909; September 9, 1910, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on right bank 1½ miles below highway bridge, November 14, 1913, to September 30, 1916; inspected by Harry Cowling. Inclined staff on left bank one-fourth mile above bridge, February 26, 1907, to November 13, 1913; prior to February, 1907, several gages at slightly different sites and datums.

Discharge measurements.—Made from cable just below gage or by wading.

Channel and control.—Bed composed of gravel and sand. Rock riffle a short distance below gage affords fairly permanent control. One channel at all stages.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 3.05 feet at 1 p. m. June 18 (discharge, 438 second-feet); channel dry October 1-11 and September 10-30.

1896-1916: Maximum stage recorded, 10.0 feet January 26, 1914 (discharge, 2,400 second-feet); channel dry in August, September, and October, 1915, and September, 1916.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Below all tributaries and all diversions except those of Hunter & Banks ranch 3 miles downstream.

Regulation.—Flow affected by diversions above.

Accuracy.—Stage-discharge relation changed slightly during year; affected by ice during January and February. Rating curve well defined between 0 and 1,200 second-feet. Operation of water-stage recorder satisfactory except for breaks in record shown in footnote to table of daily discharge. Daily discharge ascertained by applying to rating tables the mean daily gage height determined by inspecting recorder graph, except during periods when stage-discharge relation was affected by ice or the gage height record was missing. Records obtained by use of rating table good. others fair.

Discharge measurements of South Fork of Humboldt River near Elko, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 9[a]	A. B. Purton	0.54	7.7	May 13	L. W. Jordan	1.86	155
Dec. 14[b]	L. W. Jordan	.71	13.7	June 18	.....do	3.03	439
Jan. 7[c]	.....do	.75	9.7	Aug. 14	.....do	.03	0.7
Mar. 22[d]	.....do	2.91	365				

[a] Stage of zero flow determined zero on gage.

[b] Slight shore ice.

[c] Complete ice cover at gage; control partly open.

[d] Some driftwood lodged on control.

Daily discharge, in second-feet, of South Fork of Humboldt River near Elko, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	7.4	13	....	159	182	64	137	....	1.0
2	....	7.7	12	....	170	178	66	136	....	.8
3	....	7.7	12	....	170	178	62	174	....	.6
4	....	7.4	12	....	172	186	65	139	....	.6
5	....	7.1	13	....	167	214	90	122	....	.5
6	....	7.4	13	....	157	217	139	116	....	.5
7	....	7.7	12	....	152	228	176	107	....	.3
8	....	7.4	12	....	150	243	206	105	0.7	.2
9	....	7.7	12	....	152	245	258	103	.7	.1
10	....	8.0	12	....	163	208	292	....	.7	.0
11	0.0	7.4	13	....	199	193	314	....	.7	....
12	.2	8.0	12	....	240	174	312	....	.7	....
13	.9	7.4	14	....	226	156	312	....	.7	....
14	1.3	6.5	13	....	199	139	332	....	.6	....
15	2.8	8.6	11	90	182	129	344	....	.7	....
16	2.4	9.2	9.2	148	178	108	350	....	.6	....
17	3.3	9.5	8.9	205	176	92	347	....	.6	....
18	3.6	8.9	6.8	263	174	87	388	....	.6	....
19	3.8	13.0	4.5	320	184	134	353	....	.5	....
20	4.2	11.0	9.5	334	180	116	312	....	.5	....
21	4.5	11.0	9.5	348	172	93	265	....	.5	....
22	5.2	10.0	11	362	159	80	208	33	.5	....
23	4.8	9.5	16	318	147	65	167	....	.5	....
24	4.5	11.0	12	273	137	80	150	....	.4	....
25	5.5	6.5	11	228	145	167	147	....	.4	....
26	6.2	12.0	10	233	163	188	159	....	.4	....
27	6.5	9.5	....	226	182	149	172	....	.5	....
28	6.5	13.0	....	219	188	120	188	....	.5	....
29	6.8	16.0	....	210	184	103	168	....	.6	....
30	7.1	14.0	....	184	178	89	145	....	.7	....
31	7.1	....	....	168	....	73	....	....	1.0	....

NOTE.—Discharge obtained as follows: Interpolated because of missing gage height record, Dec. 27–31, 10 second-feet; Mar. 6–14, 70 second-feet; July 10–21, 68 second-feet; July 23–31, 18 second-feet; Aug. 1–7, 2 second-feet; estimated on account of ice, from observer's notes, one discharge measurement, and study of North Fork Humboldt and Humboldt at Palisade records: Jan. 1 to Feb. 15, 10 second-feet; Feb. 16–29, 20 second-feet; Mar. 1–5, 30 second-feet. Zero discharge Oct. 1–11, and Sept. 10–30.

Monthly discharge of South Fork of Humboldt River near Elko, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	7.1	0	2.81	173
November	13	7.1	9.25	550
December	16	4.5	11.1	682
January	....	....	10	615
February	....	....	14.8	851
March	362	....	158	9,720
April	240	137	174	10,400
May	245	65	149	9,160
June	388	62	218	13,000
July	174	....	69.4	4,270
August	....	.4	.913	56
September	1	0	.153	9
The year	388	0	65.1	49,500

MAGGIE CREEK AT CARLIN, NEV.

Location.—In sec. 26, T. 33 N., R. 52 E., 500 feet above highway bridge, half a mile above confluence with Humboldt River, and half a mile east of Carlin, Elko County.

Drainage area.—Not measured.

Records available.—June 6, 1913, to September 30, 1916.

Gage.—Inclined staff on left bank about 600 feet above Pacific Fruit Express Co.'s dam, October 26, 1913, to September 30, 1916; vertical staff at the bridge 100 feet above dam June 6 to October 25, 1913. Read by B. L. Hale and J. F. Robinson.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Bed composed of sand and gravel; shifts occasionally. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 3.09 feet April 11 (discharge, 183 second-feet); minimum discharge not determined.

1913–1916: Maximum stage recorded, 4.5 feet April 28, 1914 (discharge, 394 second-feet); minimum stage, 0.95 foot August and September, 1915 (discharge, 0.1 second-foot).

Diversions.—No information.

Regulation.—No information.

Accuracy.—Stage-discharge relation changed during high water in March and April; affected by backwater from dam and ice on control November 20 to February 5, and from dam April 28 to May 1. Rating curves fairly well defined for range of stage during periods used. Gage read to hundredths twice daily but readings not always reliable, and from May 4 to September 30 were considered of no value. Daily discharge determined by applying mean daily gage height to rating tables except during periods when stage-discharge relation was affected by ice, backwater from dam, or shifting control. See footnote to daily discharge table. Records obtained by use of rating tables fair; others poor.

Discharge measurements of Maggie Creek at Carlin, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 7 [a]	1.60	1.7	May 3	2.36	114	June 27	1.00	15.8
Mar. 9	1.92	14.7	June 15	1.20	27.6	Aug. 28	.37	1.5

[a] Incomplete ice cover at control.

Daily discharge, in second-feet, of Maggie Creek at Carlin, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Feb.	Mar.	Apr.	May.	June.	Aug.
1	2.6	6.1	....	....	129	118	....	....
2	2.6	4.3	....	....	137	118	....	....
3	3.1	3.7	....	....	141	111	....	....
4	3.1	4.3	....	....	147	....	....	....
5	3.7	5.2	....	13	152	....	....	....
6	3.7	5.2	2.2	13	157	....	....	....
7	3.7	5.2	2.2	14	162	....	....	....
8	4.3	4.3	2.2	15	168	....	....	....
9	3.7	5.2	1.8	15	174	....	....	....
10	3.7	3.7	1.8	15	179	....	....	....
11	5.2	3.1	3.7	16	183	....	....	....
12	4.3	....	6.1	16	182	....	....	....
13	5.2	....	8.8	16	182	....	....	....
14	7.4	....	12	16	181	....	....	....
15	5.2	....	14	17	180	....	25	....
16	6.1	....	18	17	....	....	....	....
17	5.2	....	14	17	....	....	....	....
18	6.1	....	12	16	....	....	....	....
19	7.4	....	8.8	18	....	....	....	....
20	5.2	....	8.8	22	....	....	....	....
21	7.4	....	7.4	22	....	....	....	....
22	7.4	....	7.4	27	....	....	....	....
23	6.1	....	....	34	131	....	....	....
24	7.4	....	....	37	127	....	....	....
25	5.2	....	....	54	121	....	....	....
26	6.1	....	....	62	121	....	....	....
27	7.4	....	....	78	121	....	16	....
28	4.3	....	....	86	120	....	....	1.7
29	4.3	....	....	96	120	....	....	....
30	6.1	....	....	118	119	....	....	....
31	5.2	....	....	123	....	....	....	....

NOTE.—Mean discharge estimated on account of ice and backwater from temporary dam as follows:

	Second-feet.		Second-feet.
Nov. 12–30	3	Feb. 1–5	2
Dec. 1–31	2	Feb. 23 to Mar. 4	10
Jan. 1–31	1		

Interpolated because of unreliable gage readings:

	Second-feet.		Second-feet.
Apr. 16–20	155	June 28–30	16
May 4–31	83	July 1–31	12
June 1–14	39	Aug. 1–27	5
June 16–26	20		

Estimated because of unreliable gage readings:

	Second-feet.		Second-feet.
Aug. 29–31	1.5	Sept. 1–30	1

Monthly discharge of Maggie Creek at Carlin, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	7.4	2.6	5.11	314
November	....	....	3.58	213
December	....	....	2.00	123
January	....	....	1.00	61.5
February	18	....	7.28	419
March	123	....	33.4	2,050
April	183	119	151	8,980
May	118	....	86.2	5,300
June	....	....	28.5	1,700
July	....	....	12.0	738
August	....	....	4.55	280
September	....	....	1.00	59.5
The year	183	....	27.8	20,200

ROCK CREEK AT ROCK CREEK RANCH, NEAR BATTLE MOUNTAIN, NEV.

Location.—Approximately in sec. 6, T. 37 N., R. 47 E., at old footbridge about a mile above diversion dam at mouth of canyon, 1½ miles above Rock Creek ranch house, a few miles south of Dutton, and 35 miles north of Battle Mountain, Lander County. Willow Creek is the only large tributary between this station and the one maintained several miles below in 1896.

Drainage area.—Not measured.

Records available.—May 13, 1915, to September 30, 1916.

Gage.—Vertical staff near left end of footbridge; datum raised 0.62 June 14, 1916; read by foreman of Rock Creek ranch.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Bed composed of rocks and gravel, likely to shift at extremely high stages. One channel at all stages. Banks high and clean.

Extremes of discharge.—Maximum discharge from discharge measurement, March 21, 1916, 933 second-feet; minimum discharge not determined.

1915–1916: Maximum discharge, same as above; minimum stage recorded, 1.2 feet July 5 and 7, 1915 (discharge, 0.4 second-feet).

Diversions.—Numerous small diversions above station; there is a small reservoir on one of the tributaries above Squaw Valley.

Regulation.—Flow affected by diversions and storage above.

Accuracy.—Stage-discharge relation permanent. Rating curve well defined between 0 and 100 second-feet. Gage read three times a week, October 1 to November 2, and once a week, May 12 to September 30. Gage not read November 3 to May 11 except at time of measurement, on March 21. Discharge determined by applying gage heights to rating table. Records fair.

Discharge measurements of Rock Creek at Rock Creek ranch, near Battle Mountain, Nev., during the year ending Sept, 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 21	6.06	933
May 12	2.82	101
June 14	[a] 1.50	22.4

[a] New datum; 1.50 new=2.12 old.

Daily discharge, in second-feet, of Rock Creek at Rock Creek ranch, near Battle Mountain, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Mar.	May.	June.	July.	Aug.	Sept.
1						85		
2	4.4	4.4						4.9
3					41			
4	4.4							
5							4.9	
6	4.4							
7								
8						45		
9	4.4							4.9
10	4.4				41			
11								
12				101			4.9	
13	4.4							
14					22			
15						28		
16	4.4							4.9
17	4.4				83			
18								
19	4.4						4.9	
20				49				
21	4.4		933					
22						10		
23	4.4							4.9
24	4.4				83			
25								
26	4.4						4.9	
27	4.4			41				
28	4.4							
29						7.3		
30	4.4							
31	4.4							

NOTE.—Daily discharge not determined for periods when gage was not read.

REESE RIVER NEAR BERLIN, NEV.

LOCATION.—In SW. ¼ sec. 16, T. 12 N., R. 40 E., close to boundary of Toiyabe National Forest, just above mouth of Illinois Creek, 1½ miles below Archie Bell's ranch, 2 miles above Bell home ranch, 7 miles east of Berlin, Nye County, and 55 miles south of Austin, Nev.

DRAINAGE AREA.—94 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 10, 1913, to November 10, 1914; March 1 to December 11, 1915, and May 7 to September 30, 1916.

GAGE.—Vertical staff on left bank 300 feet above headgate of the upper Bell ditch, read by Roy Bell; gage 10 feet downstream with datum 1.17 feet higher read June 29, 1915, to September 30, 1916; an auxiliary gage, about 1½ miles below the regular gage, used November 1, 1913, to April 28, 1914, October 20 to November 10, 1914, and March 1 to April 18, 1915, when no water was being diverted between gages.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of sand and small gravel. Stream very crooked. Banks low, covered with a thick growth of willows; subject to overflow at high stages. Control at low stages is fairly well defined gravel riffle a few feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year during period when gage height record was obtained, 2.90 feet May 7 (discharge, 65 second-feet); minimum stage, 0.90 foot September 29 and 30 (discharge, 1.5 second-feet).

ICE.—Station discontinued during winter.

Diversions.—A small amount of water is diverted at the Archie Bell ranch above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent. Measurements define a reversed curve, well defined between 0 and 200 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, interpolating discharge for days when gage was not read. Records fair.

The records of daily and monthly discharge for the years 1914 and 1915 are published herewith, recomputed by means of a rating curve developed from all discharge measurements made during the period October 1, 1913, to September 30, 1916.

Discharge measurements of Reese River near Berlin, Nev., during the period Oct. 1, 1913, to Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
1913.		*Feet.*	*Sec.-ft.*
Oct. 12	J. J. Sanford	[a] 0.99	3.4
1914.			
May 23	L. W. Jordan	4.20	164.
July 9	do	1.53	21.3
10	do	1.58	22.2
1915.			
Apr. 17	A. B. Purton	2.83	62
17	do	[b] 2.80	64
June 28	A. B. Purton	1.86	37.4
28	do	1.86	38.2
28	do	[c] 3.22	28.6
29	do	1.84	37.9
Sept. 10	do	.91	1.9
1916.			
May 7	L. W. Jordan	2.89	62
June 26	do	1.42	15.3
Aug. 27	do	.96	3.1

[a] Gage heights refer to datum established June 29, 1915.
[b] Auxiliary gage read 4.30 feet one hour later, with no diversions between gages.
[c] Measurement at auxiliary gage; water being diverted between gages.

Daily discharge, in second-feet, of Reese River near Berlin, Nev., for the years ending Sept. 30, 1914, 1915, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	4.5	5.0	5	7	......	7	17	62	118	29	8.5	3.5
2	4.5	3.5	5	7	......	9	17	59	128	29	8.5	3.5
3	4.5	3.5	5	7	......	11	22	118	118	26	7	3.5
4	4.5	3.5	5	9	......	9	34	118	109	24	5.5	3.5
5	4.5	3.5	5	9	......	9	37	118	114	24	5.5	3.5
6	2.5	3.5	5	9	......	9	34	109	109	22	5.5	3.5
7	2.5	3.5	......	9	......	10	37	101	109	22	5.5	3.5
8	1.0	3.5	......	9	......	11	34	109	101	22	5.5	4.5
9	1.0	3.5	......	......	......	15	34	109	88	22	5.5	3.5
10	2.5	5.0	......	......	......	19	34	114	78	22	5.5	3.5
11	4.5	5.0	......	......	......	22	34	118	73	22	5.5	3.5
12	2.5	3.5	......	......	......	25	34	114	69	19	5.5	3.5
13	2.5	3.5	......	......	......	25	34	118	69	19	7	3.5
14	2.5	3.5	......	......	......	28	40	128	62	19	7	3.5
15	2.5	5.0	......	......	......	31	40	118	59	17	5.5	3.5
16	2.5	5	......	......	......	37	43	151	59	17	5.5	3.5
17	2.5	5	......	......	......	34	57	139	54	19	5.5	3.5
18	2.5	5	......	......	......	34	46	128	52	19	5.5	3.5
19	2.5	5	......	......	......	37	46	123	52	40	5.5	3.5
20	2.5	5	......	......	......	37	53	145	53	47	3.5	3.5
21	2.5	3.5	......	......	......	37	46	158	52	54	3.5	3.5
22	2.5	3.5	......	......	13	40	40	164	50	19	3.5	4.5
23	2.5	3.5	......	......	10	40	43	158	49	15	8.5	4.5
24	2.5	5.0	......	......	7	37	46	151	47	13	5.5	5.5
25	2.5	3.5	......	......	5	43	43	128	44	12	4.5	7
26	2.5	3.5	......	......	3.5	43	46	109	40	12	3.5	8.5
27	4.5	5	......	......	7	46	43	88	42	12	2.5	4.5
28	2.5	7	......	......	7	43	49	94	40	12	2.5	4.5
29	2.5	7	......	......	......	40	59	98	40	10	3.5	4.5
30	2.5	5	7	......	......	40	62	94	38	10	3.5	5.5
31	2.5	......	7	......	......	40	......	128	......	10	3.5	......

Daily discharge, in second-feet, of Reese River near Berlin, Nev., for the years ending Sept. 30, 1914, 1915, 1916—Continued.

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.									
1	5.5	7	7	28	69	118	35	17	....
2	5.5	7	7	28	62	128	35	17	....
3	5.5	7	8	28	62	128	35	16	....
4	5.5	7	8	30	62	128	36	16	....
5	5.5	7	8	31	65	118	36	14	....
6	5.5	7	7	32	69	101	35	14	....
7	5.5	7	7	34	71	86	35	14	....
8	5.5	7	7	34	71	69	34	....	....
9	5.5	7	7	34	73	69	31	....	....
10	5.5	7	7	34	69	69	27	....	1.7
11	5.5	....	7	34	73	67	25	....	1.5
12	5.5	....	7	34	73	67	21	....	2.3
13	4.5	....	7	37	69	67	21	....	2.3
14	3.5	....	11	40	73	62	20	....	2.3
15	5.5	....	11	42	73	62	20	....	2.5
16	5.5	....	12	43	78	60	20	....	2.7
17	5.5	....	12	59	80	59	19	....	2.7
18	5.5	....	13	57	73	58	19	....	2.3
19	5.5	....	12	65	73	56	19	....	2.3
20	7.0	....	12	65	69	54	21	....	2.7
21	7.0	....	12	62	65	52	22	....	2.7
22	5.0	....	13	62	62	51	22	....	2.5
23	5.0	....	13	62	65	50	21	....	2.7
24	6.0	....	13	65	69	48	21	....	2.7
25	7.0	....	13	65	78	47	20	....	3.1
26	7.0	....	13	62	78	47	19	....	3.1
27	7.0	....	13	65	78	47	19	....	3.1
28	9.0	....	25	62	78	40	18	....	3.1
29	7.0	....	25	69	88	37	17	....	3.1
30	7.0	....	28	65	101	36	17	....	3.1
31	7.0	....	30	....	105	....	17	....	....

Day.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.
1915-16.								
1	3.1	....	....	....	36	11.0	3.5	3.1
2	3.1	....	....	....	40	12	3.5	2.9
3	3.1	....	....	....	37	12	3.5	2.7
4	2.9	....	....	....	39	11	3.5	2.5
5	3.1	....	5.5	....	41	8.5	3.5	2.5
6	3.1	....	4.5	....	43	7.6	3.5	2.5
7	2.9	5.5	4.5	65	44	8.0	3.5	1.9
8	3.1	5.5	5.1	64	47	8.5	3.5	1.7
9	3.1	5.5	5.1	63	46	7.9	3.5	1.5
10	3.9	5.5	5.3	60	46	8.5	3.5	1.9
11	4.7	5.5	5.3	58	47	8.5	3.5	2.0
12	5.5	5.5	....	56	46	11	3.5	2.2
13	5.5	5.1	....	54	46	12	3.5	2.3
14	5.5	4.7	....	52	40	10	3.5	2.1
15	5.3	4.7	....	50	40	8.5	3.5	1.9
16	5.1	4.3	....	49	40	8.5	3.5	1.9
17	5.1	4.1	....	48	33	8.5	3.5	2.3
18	5.1	4.3	....	48	26	7.9	3.5	2.3
19	....	3.9	....	48	19	8.5	3.5	2.3
20	....	3.5	....	48	24	8.5	3.1	2.5
21	....	5.1	....	48	23	8.5	3.1	2.7
22	....	5.1	....	47	22	7.9	3.1	2.7
23	....	5.3	....	48	21	7.3	3.0	2.7
24	....	5.1	....	48	20	6.7	2.9	2.3
25	....	5.5	....	48	19	5.9	2.9	2.7
26	....	5.1	....	47	19	5.1	2.8	3.1
27	....	5.5	....	44	12	5.3	2.7	2.6
28	3.5	5.5	....	40	12	5.5	3.1	2.0
29	....	5.5	....	40	12	4.5	3.1	1.5
30	....	5.5	....	39	12	3.5	3.1	1.5
31	....	....	....	36	....	3.5	3.1	....

NOTE.—1914-15: Discharge interpolated Aug. 8-31, 10 second-feet; Sept. 1-9, 3.4 second-feet. 1915-16: Discharge interpolated Oct. 19-27, 4.3 second-feet; Oct. 29-31, 3.8 second-feet; Nov. 1-6, 4.9 second-feet; Dec. 1-4, 5.5 second-feet.

Monthly discharge of Reese River near Berlin, Nev., for the years ending Sept. 30, 1914, 1915, and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1913-14.				
October	4.5	1	2.85	175
November	7	3.5	4.33	258
December	....	....	3.65	224
January	....	....	5.84	359
February	....	....	7.12	395
March	46	7	28.0	1,720
April	62	17	40.1	2,390
May	164	59	118	7,260
June	128	38	70.5	4,200
July	54	10	21.3	1,310
August	8.5	2.5	5.26	323
September	8.5	3.5	4.12	245
The year	164	1	26.1	18,900
1914-15.				
October	9.0	3.5	5.89	362
November 1-10	7.0	7.0	7.00	139
March	30	7.0	12.1	744
April	69	28	47.6	2,830
May	105	62	73.4	4,510
June	128	36	69.4	4,130
July	36	17	24.4	1,500
August	17	....	11.2	689
September	....	1.5	2.84	169
1915-16.				
October	5.5	2.9	4.09	251
November	5.5	3.5	5.01	298
December 1-11	5.5	4.5	5.21	114
May 7-31	65	36	49.9	2,220
June	47	12	31.7	1,890
July	12	3.5	8.08	497
August	3.5	2.7	3.31	204
September	3.1	1.5	2.29	136

BIG CREEK NEAR AUSTIN, NEV.

Location.—In sec. 9, T. 17 N., R. 43 E., above headgate of W. S. Carter's ditch, half a mile above Carter ranch, and 14 miles southwest of Austin, Lander County.

Drainage area.—About 9 square miles (measured on map issued by United States Forest Service).

Records available.—October 12, 1913, to June 30, 1914; March 9 to September 30, 1916.

Gage.—Vertical staff on left bank 5 feet above timber control; read by W. S. Carter. Original gage was a vertical staff nailed to willow tree on left bank 300 feet upstream, read October 12, 1913, to June 30, 1914.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of gravel. Control is timber flume, 6 feet long, 4 feet wide at bottom, with battered sides; point of zero flow at gage height, 0.0. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 0.71 foot July 4 (discharge, 9.8 second-feet); minimum stage recorded, 0.45 foot May 21 (discharge, 3.1 second-feet).

1914, 1916: Maximum stage recorded during period, 1.78 feet June 7, 1914 (discharge, 10.8 second-feet); minimum stage recorded May 21, 1916.

Ice.—No information.

Diversions.—Water diverted above station to irrigate a few acres of meadow.

Regulation.—Flow at gage affected at times by irrigation diversions above.

Accuracy.—Stage-discharge relation affected by filling in channel above artificial control. Rating curves not well defined because of lack of sufficient discharge measurements; one used March 9 to June 10 and the other June 26 to September 30. Gage read to hundredths once daily. Gage readings on days when water was diverted above not apt to be actual mean. Daily discharge ascertained by applying daily gage height to rating tables and by interpolating for short periods when gage was not read. For long periods of missing gage heights, daily discharge not determined. Records fair.

Discharge measurements of Big Creek near Austin, Nev., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 7[a]	L. W. Jordan	0.65	6.21
June 26	C. C. Jacob	.67	8.4
Aug. 27	L. W. Jordan	.40	3.0

[a] Stage of zero flow determined as zero on gage.

Daily discharge, in second-feet, of Big Creek near Austin, Nev., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	....	4.0	4.5	5.3	8.8	....	3.3
2	....	4.3	5.1	5.3	9.1	....	3.3
3	....	4.3	5.1	5.5	9.1	....	3.3
4	....	4.2	5.3	5.7	9.8	....	3.3
5	....	4.2	5.3	5.9	....	....	3.4
6	....	4.2	5.5	6.1	....	....	3.4
7	....	4.3	6.4	6.6	....	....	3.5
8	....	4.2	5.9	6.6	....	....	3.5
9	4.0	4.2	5.9	6.6	....	....	3.6
10	4.0	4.2	6.1	6.8	....	....	3.6
11	4.0	4.3	5.3	7.4	....	....	3.6
12	4.0	4.3	3.7	7.5	....	....	3.9
13	4.0	4.3	4.5	7.6	....	....	3.9
14	4.0	4.2	4.7	7.6	....	....	3.9
15	4.0	4.2	4.5	7.7	....	....	3.9
16	4.0	4.2	4.3	7.8	....	....	3.9
17	4.0	4.2	4.5	7.9	....	....	3.9
18	4.0	4.3	4.5	7.9	....	....	3.9
19	4.0	4.2	4.0	8.0	....	....	3.9
20	4.0	4.2	3.7	8.1	....	....	3.9
21	4.0	4.2	3.1	8.2	....	....	3.9
22	4.0	4.3	4.3	8.2	....	....	4.2
23	4.0	4.3	4.5	8.3	....	....	3.9
24	4.0	4.3	4.5	8.4	....	....	3.6
25	4.0	4.5	4.5	8.5	....	....	3.6
26	4.2	4.5	4.7	8.5	....	....	3.6
27	4.2	4.7	5.5	7.0	....	3.3	3.6
28	4.2	5.0	4.8	8.2	....	3.3	3.6
29	4.0	5.1	5.0	8.5	....	3.3	3.6
30	4.0	5.0	5.1	8.5	....	3.4	3.6
31	4.0	....	5.1	....	....	3.6	....

Note.—Discharge interpolated June 12-25 and Sept. 3-9. No gage height record July 5 to Aug. 26.

Monthly discharge of Big Creek near Austin, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 9-31	4.2	4.0	4.03	184
April	5.1	4.0	4.35	259
May	6.4	3.1	4.84	298
June	8.5	5.3	7.34	437
September	4.2	3.3	3.67	218

HUMBOLDT-LOVELOCKS IRRIGATION, LIGHT & POWER CO.'S FEEDER CANAL NEAR MILL CITY, NEV.

Location.—In SW. ¼ sec. 29, T. 33 N., R. 35 E., a quarter of a mile below head of canal, and about 2 miles north of Mill City, Humboldt County.

Records available.—February 19, 1914, to September 30, 1916.

Gage.—Stevens continuous water-stage recorder on left bank; inspected by Peter Organ.

Discharge measurements.—Made from footbridge at gage or by wading.

Channel and control.—Earth section. Control indefinite; stage discharge relation is affected by growth of aquatic plants and by the wash from several small gullies below the station.

Extremes of discharge.—1914–1916: Maximum stage, from water-stage recorder, 4.78 feet at 6 a. m. April 5, 1916 (discharge, 243 second-feet); canal dry October 1, 1915, to February 6, 1916, and June 13 to September 30, 1916.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—None.

Regulation.—Flow regulated by head gates one-fourth mile above station.

Accuracy.—Stage-discharge relation permanent; not affected by ice. Rating curve well defined between 0 and 250 second-feet. Operation of water-stage recorder satisfactory except for March 13-18 when daily staff gage readings were used, and June 9–12. Daily discharge ascertained by applying to rating table the mean daily gage heights determined by inspecting recorder graph except February 7, 29, March 11, 12, 18, 24, April 6, 9, 20, and May 18 for which it was determined by averaging the discharge values obtained by applying the rating table to hourly gage height, and June 9–12 when it was interpolated. Records good.

Canal diverts from Humboldt River in sec. 29, T. 33 N., R. 35 E., for storage in the Taylor-Pitt reservoirs near Humboldt. The water is returned to the river during the irrigation season, about 3 miles west of Humboldt through the Humboldt-Lovelocks Irrigation, Light & Power Co. outlet canal and carried in the natural channel to the headgates of the canals serving the Lovelocks district.

Discharge measurements of Humboldt-Lovelocks Irrigation, Light & Power Co.'s feeder canal near Mill City, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan].

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 11	4.37	206
19	.94	4.0
May 10	2.21	45.3

Daily discharge, in second-feet, of Humboldt-Lovelocks Irrigation, Light & Power Co.'s feeder canal near Mill City, Nev., for the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	June.	Day.	Feb.	Mar.	Apr.	May.	June.
1		134	208	142	2.4	16	18	226	13	69	
2		160	173	134	2.4	17	52	226	12	68	
3		194	164	118	2.4	18	99	172	9.8	29	
4		204	212	110	2.4	19	114	5.2	7.8	4.2	
5		208	217	106	2.4	20	99	2.8	46	3.8	
6	0.0	212	120	96	2.4	21	106	1.7	118	3.4	
7	.3	217	61	92	2.0	22	114	1.3	122	3.0	
8	7.4	226	56	92	1.3	23	130	1.3	114	2.9	
9	9.6	226	36	85	1.0	24	134	40	110	2.5	
10	9.4	217	22	51	.8	25	134	110	110	2.5	
11	7.6	156	21	40	.5	26	130	155	114	2.5	
12	18	41	20	48	.2	27	130	199	122	2.5	
13	19	168	20	61	.0	28	130	226	102	2.5	
14	17	217	18	73		29	109	226	122	2.5	
15	13	226	15	70		30		226	138	2.5	
						31		226		2.5	

NOTE.—Canal dry Oct. 1 to Feb. 6 and June 13 to Sept. 30.

Monthly discharge of Humboldt-Lovelocks Irrigation, Light & Power Co.'s canal near Mill City, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October				0
November				0
December				0
January				0
February 6-29	134	0	66.7	3,180
March	226	1.3	157	9,650
April	217	7.8	87.4	5,200
May	142	2.5	49.1	3,020
June 1-13	2.4	0		40
July				0
August				0
September				0
The year				21,100

HUMBOLDT-LOVELOCKS IRRIGATION, LIGHT & POWER CO.'S OUTLET CANAL NEAR HUMBOLDT, NEV.

LOCATION.—In SE. ¼ sec. 30, T. 32 N., R. 33 E., at outlet of lower Taylor-Pitt reservoir, about 2½ miles west of Humboldt, Humboldt County.

RECORDS AVAILABLE.—February 15, 1914, to September 30, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank about 100 feet above the weirs; inspected by Albert Olson.

DISCHARGE MEASUREMENTS.—Made from a footbridge one-fourth mile below gage or by wading.

CHANNEL AND CONTROL.—Two 8-foot Cippoletti weirs form a permanent control. There is no flow at 0 gage height.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 1.97 feet July 24 (discharge, 153 second-feet); canal dry October 1 to June 5, except for a few days in May, and August 29 to September 30.

1914–1916: Maximum stage recorded, 3.02 feet at noon April 30, 1915 (discharge, 296 second-feet).

ICE.—Gates usually closed during winter.

DIVERSIONS.—None.

Regulation.—Flow regulated by outlet gates a few hundred feet above station.

Accuracy.—Stage-discharge relation permanent; not affected by ice. Rating curve well defined between 0 and 150 second-feet. Operation of water-stage recorder satisfactory except during May when clock was not running. Daily discharge ascertained by applying to rating table the mean daily gage height taken from graph by inspection, except that for June 6, 13, 21, July 6, August 3, 10, 17, 18, and 28, it was determined by averaging the discharge obtained by applying hourly gage height to rating table. Discharge not determined for a few days in May when head gates were opened and clock was not running. Records good.

The following discharge measurement was made by L. W. Jordan:

June 12, 1916: Gage height, 0.97 foot; discharge, 51 second-feet.

Canal conducts stored water released from the Taylor-Pitt Reservoirs to the Humboldt River in the SW. ¼ sec. 31, T. 33 N., R. 33 E., for irrigation use in Lovelocks Valley several miles downstream.

Daily discharge, in second-feet, of Humboldt-Lovelocks Irrigation, Light & Power Co.'s outlet canal near Humboldt, Nev., for the year ending Sept. 30, 1916.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	......	39	130	11	50	103	66	21	96	148	14
2	......	89	129	12	51	103	59	22	46	133	14
3	......	39	95	13	71	121	55	23	40	149	14
4	......	39	49	14	104	129	55	24	38	153	14
5	0	38	38	15	104	129	56	25	38	142	13
6	11	94	35	16	103	144	56	26	38	125	14
7	45	101	37	17	101	147	30	27	38	123	14
8	45	102	37	18	99	144	10	28	38	128	9.3
9	46	102	37	19	101	147	14	29	39	130	.0
10	50	102	65	20	107	148	14	30	39	130	......
								31	......	130	......

Note.—Head gate opened for a few days in May when recording gage was not running. Except for this period canal was dry Oct. 1 to June 5 and Aug. 29 to Sept. 30.

Monthly discharge of Humboldt-Lovelocks Irrigation, Light & Power Co.'s outlet canal near Humboldt, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June 5–30	107	0	59.2	3,050
July	153	38	113	6,950
August 1–29	130	0	40.5	2,300
The period	....	....	....	12,300

PYRAMID AND WINNEMUCCA LAKES BASIN.

LAKE TAHOE AT TAHOE, CAL.

Location.—In SE. ¼ sec. 6, T. 15 N., R. 17 E., near outlet of lake at Tahoe, Placer County.

Drainage area.—519 square miles (including water surface of lake, which is 193 square miles).

Records available.—1900 to September 30, 1916.

Gage.—Vertical staff fastened to piling of boat landing near outlet; read by an employee of the United States Reclamation Service. Datum is 6,220 feet above sea level. Mean low-water elevation of lake is 6,226.0 feet.

Extremes of stage.—Maximum stage recorded during year, 9.80 feet July 14 to 18 and 20 to 24; minimum stage recorded, 6.96 feet December 1 and 2.

1900–1916: Maximum stage recorded, 11.26 feet July 14, 15, 17, and 18, 1907; minimum stage recorded, 4.68 feet December 19 to 21, 1913.

Accuracy.—Gage is read to hundredths once daily; not read when water-surface is rough.

Cooperation.—Record furnished by United States Reclamation Service.

Daily gage height, in feet, of Lake Tahoe at Tahoe, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.80	7.35	6.96	7.00	8.05	8.11	8.12	8.58	9.17	9.68	9.68	9.24
2	7.79	7.34	6.96	7.02	8.05	8.18	8.12	8.60	9.18	9.69	9.67	9.22
3	7.76	7.34	6.97	....	....	8.16	8.12	8.62	9.19	9.70	9.66	9.19
4	7.75	7.32	7.09	7.32	8.10	8.14	8.12	8.64	9.21	9.71	9.65	9.17
5	7.74	7.31	7.09	....	8.08	8.15	8.13	8.68	9.24	9.72	9.64	9.15
6	7.73	7.28	7.10	7.27	....	8.14	8.14	8.74	9.28	9.74	9.63	9.14
7	7.73	7.25	7.10	7.30	8.05	8.14	8.15	8.77	9.30	9.74	9.60	9.12
8	7.72	7.21	7.10	....	....	8.13	8.17	8.79	9.32	9.75	9.58	9.09
9	7.70	7.32	7.80	....	8.06	8.12	8.19	8.81	9.35	9.76	9.55	9.06
10	7.68	7.27	7.80	....	8.08	8.10	8.20	8.83	9.38	9.76	9.53	9.04
11	7.66	7.24	7.80	7.32	8.08	8.09	8.22	8.84	9.40	9.77	9.52	9.02
12	7.64	7.22	7.40	....	8.08	8.08	8.24	8.86	9.43	9.78	9.52	9.00
13	7.60	7.20	7.12	7.50	8.08	8.06	8.25	8.88	9.45	9.79	9.50	9.00
14	7.59	7.19	7.22	....	8.08	8.05	8.27	8.89	9.48	9.80	9.48	8.99
15	7.58	7.17	7.22	7.61	8.08	8.04	8.28	8.91	9.50	9.80	9.47	8.98
16	7.56	7.15	7.21	....	8.08	8.03	8.28	8.92	9.53	9.80	9.46	8.97
17	7.55	7.13	7.19	7.68	8.08	8.02	8.29	8.94	9.56	9.80	9.44	8.96
18	7.53	7.10	7.19	....	8.06	8.01	8.30	8.96	9.57	9.80	9.42	8.94
19	7.52	7.10	7.18	7.73	8.05	8.02	8.33	8.98	9.58	9.79	9.39	8.92
20	7.51	7.09	7.18	7.72	8.06	8.06	8.35	9.01	9.59	9.80	9.37	8.90
21	7.49	....	7.15	....	8.07	8.07	8.37	9.02	9.60	9.80	9.34	8.88
22	7.48	....	7.13	7.78	8.07	8.07	8.39	9.04	9.62	9.80	9.32	8.95
23	7.45	7.03	7.12	7.78	8.06	8.08	8.40	9.06	9.63	9.80	9.31	8.93
24	7.44	....	7.11	....	8.05	8.09	8.42	9.07	9.65	9.80	9.30	8.91
25	7.43	7.00	7.10	7.82	8.05	8.10	8.44	9.09	9.67	9.79	9.29	8.89
26	7.41	7.02	7.08	7.82	8.07	8.10	8.46	9.11	9.67	9.78	9.29	8.86
27	7.40	7.01	7.08	7.87	8.08	8.10	8.48	9.13	9.67	9.76	9.28	8.83
28	7.40	7.00	7.05	....	8.08	8.10	8.51	9.14	9.67	9.74	9.27	8.82
29	7.39	6.99	7.03	8.03	8.09	8.11	8.53	9.15	9.68	9.73	9.27	8.81
30	7.38	....	7.01	8.05	....	8.12	8.56	9.15	9.68	9.71	9.26	8.80
31	7.37	....	....	8.05	....	8.10	....	9.16	....	9.70	9.25	....

Note.—Lake was too rough for accurate reading on days for which gage height is not recorded.

TRUCKEE RIVER AT TAHOE, CAL.

Location.—In NW. ¼ sec. 7, T. 15 N., R. 17 E., at Tahoe, Placer County, a short distance below dam at outlet of Lake Tahoe.

Drainage area.—519 square miles.

Records available.—July 3, 1895, to February 29, 1896; June 17, 1900, to September 30, 1916.

Gage.—Vertical staff fastened to a large cottonwood tree on left bank, 300 feet below dam at outlet of Lake Tahoe. Original gage was destroyed by dredging operation July 15, 1912.

Discharge measurements.—Made from cable 140 feet below gage or by wading.

Channel and control.—Gravel; practically permanent.

Extremes of discharge.—Maximum mean daily discharge for the year, 1,010 second-feet, March 5 and 6; minimum mean daily discharge, 12 second-feet, June 3–15.

1895–96 and 1900–1916: Maximum mean daily discharge reported, 1,340 second-feet, July 13 to 20, 1907 (stage, 4.3 feet); minimum, river dry during parts of 1900, 1901, and 1914.

Ice.—Stage-discharge relation affected slightly by ice.

Diversions.—No information.

Regulation.—Flow regulated by operation of gates in dam at Lake Tahoe.

Accuracy.—Stage-discharge relation not permanent. Two well-defined rating curves used, one applicable October 1, 1915, to July 24, 1916, the other July 25 to September 30, 1916. Gage read to hundredths at least once each day. Stage controlled by outlet gates at Lake Tahoe. Daily discharge ascertained by applying mean daily-gage height to rating tables.

Cooperation.—Daily discharge and discharge measurement records furnished by United States Reclamation Service, which maintains the station in cooperation with Stone & Webster Engineering Corporation.

Discharge measurements of Truckee River at Tahoe, Cal., during the year ending Sept. 30, 1916.

[Made by R. F. Hartley].

	Gage Height.	Discharge.
July 27	3.47	521
Aug. 19	3.25	430
30	3.30	459

Daily discharge, in second-feet, of Truckee River at Tahoe, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	312	281	299	384	396	517	117	24	13	14	560	375
2	312	281	299	334	396	520	117	24	13	14	560	375
3	312	281	326	382	234	520	46	24	12	14	560	375
4	312	281	334	472	312	982	46	24	12	14	660	375
5	312	281	334	382	312	1,010	46	24	12	14	560	375
6	312	279	216	382	286	1,010	46	24	12	14	560	375
7	312	279	274	312	286	1,000	46	24	12	14	560	372
8	276	299	286	286	286	995	24	23	12	14	560	372
9	276	299	286	286	286	987	24	23	12	14	560	369
10	299	299	286	286	286	978	24	25	12	14	560	369
11	299	299	286	426	154	978	24	25	12	14	490	369
12	299	345	271	396	154	978	24	25	12	14	444	408
13	274	296	274	426	154	978	24	25	12	14	444	408
14	274	299	216	396	154	974	22	13	12	14	444	408
15	274	296	216	396	154	974	24	13	12	14	444	408
16	274	296	331	396	154	970	24	13	13	14	444	408
17	299	294	261	334	184	507	24	13	13	14	440	408
18	274	304	261	334	210	507	24	13	13	14	440	408
19	299	304	261	339	210	510	25	13	13	19	430	408
20	274	304	291	339	210	514	25	13	13	19	433	408
21	299	304	291	339	210	396	26	13	13	19	430	408
22	274	304	291	339	514	396	25	13	14	84	427	408
23	299	302	247	339	514	396	25	13	14	84	457	408
24	271	302	247	339	514	294	25	13	14	84	444	408
25	276	299	291	339	514	294	25	13	14	145	444	408
26	274	299	291	339	514	294	25	13	14	164	444	408
27	274	299	353	339	514	203	25	13	14	513	444	408
28	274	299	353	339	514	203	25	13	14	513	444	408
29	274	294	353	396	514	203	24	13	14	308	444	408
30	271	299	253	396	....	203	24	13	14	308	444	408
31	281	....	384	396	....	117	....	13	....	472	375	....

Monthly discharge of Truckee River at Tahoe, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	312	271	288	17,700
November	304	279	297	17,700
December	384	216	292	18,000
January	472	286	361	22,200
February	514	154	315	18,100
March	1,010	117	626	38,500
April	117	24	34.1	2,030
May	25	13	17.7	1,090
June	14	12	12.9	768
July	513	14	96.3	5,920
August	560	375	479	29,500
September	408	369	395	23,500
The year	1,010	12	269	195,000

NOTE.—Monthly discharge computed by United States Geological Survey.

TRUCKEE RIVER AT ICELAND, CAL.

LOCATION.—In sec. 36, T. 18 N., R. 17 E., above dam of ice company, 400 feet northeast of Southern Pacific Railroad station at Iceland, Nevada County, and about 23 miles west of Reno, Nev.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 1, 1912, to September 30, 1916.

GAGE.—Barrett & Lawrence water-stage recorder on right bank above dam; auxiliary vertical staff is fastened to gage well.

DISCHARGE MEASUREMENTS.—Made from cable 130 feet above gage.

CHANNEL AND CONTROL.—Small boulders; fairly smooth and permanent. Left bank high; right bank subject to overflow at high stages for 60 feet back from stream. Dam of National Ice Co. serves as permanent control.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge for the year, 4,370 second feet, April 11; minimum mean daily discharge, 358 second-feet, December 15. 1907–1916: Maximum mean daily discharge reported, 15,300 second-feet, March 18, 1907 (stage, 11.5 feet); minimum mean daily discharge reported, 310 second-feet, December 10, 1908 (stage, 7.9 feet).

ICE.—Stage-discharge probably somewhat affected by ice.

DIVERSIONS.—No information.

REGULATION.—See Truckee River at Tahoe.

ACCURACY.—Stage-discharge relation probably permanent. No information regarding rating curve for 1915–16. Mean daily gage height determined from water-stage recorder sheets. Daily discharge ascertained by applying mean daily gage height to rating table.

COOPERATION.—Daily discharge and discharge measurement records furnished by United States Reclamation Service, which maintains the station in cooperation with Stone & Webster Engineering Corporation.

Discharge measurements of Truckee River at Iceland, Cal., during the year ending Sept. 30, 1916.

[Made by R. E. Hartley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 7	1.56	420	July 26	1.71	575
7	1.56	411	Aug. 3	2.01	778

Daily discharge, in second-feet, of Truckee River at Iceland, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	416	403	403	490	574	920	2,220	3,010	1,510	1,010	686	497
2	390	403	390	471	574	903	2,140	2,930	1,740	1,130	767	483
3	416	423	525	560	455	920	2,220	3,170	1,680	1,060	793	483
4	416	397	504	390	525	1,400	2,370	3,570	1,940	1,010	767	483
5	416	397	525	595	525	1,470	2,690	3,650	2,160	965	767	483
6	416	390	455	686	525	1,460	2,690	3,970	2,290	965	750	469
7	416	390	371	595	546	1,470	2,770	3,410	2,280	920	734	469
8	390	403	403	539	560	1,470	3,250	2,770	2,320	920	710	469
9	390	435	423	511	560	1,470	3,650	2,610	2,400	878	734	483
10	410	423	429	471	670	1,490	4,370	2,450	2,220	792	710	483
11	410	377	403	694	670	1,680	3,490	2,370	2,070	792	670	659
12	410	390	364	710	595	1,860	2,770	2,140	1,940	792	632	525
13	390	377	423	663	525	2,010	3,010	1,940	1,900	792	632	483
14	390	390	490	633	525	2,000	3,410	1,940	2,000	710	595	686
15	377	403	358	648	511	2,240	3,410	1,960	2,140	710	581	525
16	377	403	455	633	511	2,220	3,330	2,000	2,200	632	560	497
17	390	390	455	560	525	2,000	3,170	2,000	2,200	648	560	497
18	390	390	436	560	581	2,240	2,770	2,220	2,000	648	560	497
19	390	390	403	608	567	2,770	2,450	2,070	1,740	632	581	511
20	390	390	423	560	595	3,540	2,610	2,000	1,510	422	567	511
21	435	377	442	588	625	3,060	2,850	2,070	1,350	442	574	525
22	429	390	436	560	974	2,710	3,010	2,140	1,240	422	574	553
23	423	377	403	633	920	2,350	3,250	2,000	1,240	462	574	483
24	397	390	390	560	1,010	1,810	3,330	1,680	1,240	490	574	511
25	390	377	403	560	1,200	1,680	3,410	1,460	1,300	490	574	483
26	397	390	390	560	974	1,740	3,570	1,240	1,300	670	553	483
27	397	377	403	560	1,010	1,840	3,570	1,200	1,300	792	567	497
28	403	364	476	525	920	2,070	3,570	1,350	1,200	792	581	497
29	397	371	455	567	938	2,370	3,330	1,510	1,010	750	567	483
30	397	364	483	640	......	2,450	3,010	1,510	1,010	581	581	469
31	397	......	504	640	......	2,290	......	1,510	......	686	497	......

Monthly discharge of Truckee River at Iceland, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	435	377	402	24,700
November	435	364	391	23,300
December	525	358	433	26,600
January	710	390	560	35,700
February	1,200	455	679	39,100
March	3,540	903	1,930	119,000
April	4,370	2,140	3,060	182,000
May	3,970	1,200	2,250	138,000
June	2,400	1,010	1,750	104,000
July	1,130	422	742	45,600
August	793	497	631	38,800
September	686	469	506	30,100
The year	4,370	358	1,110	807,000

NOTE.—Monthly discharge computed by United States Geological Survey.

TRUCKEE RIVER AT RENO, NEV.

LOCATION.—In sec. 11, T. 19 N., R. 19 E., at Virginia Street Bridge in Reno, Washoe County, 6 miles above mouth of Steamboat Creek, and 12 miles below Nevada-California boundary.

DRAINAGE AREA.—1,070 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 1, 1906, to September 30, 1916.

GAGE.—Vertical staff fastened to retaining wall on left bank about 20 feet below the bridge; datum 4,481.60 feet above sea level. Read by employee of U. S. Weather Bureau.

Discharge measurements.—Made from the Rock Street Bridge 800 feet below gage or by wading.

Channel and control.—Bed composed of gravel and boulders; fairly permanent. One channel at all stages; river confined by retaining walls.

Extremes of discharge.—Maximum stage recorded during year, 5.3 feet April 11 (discharge, 5,020 second-feet); minimum stage, 0.6 foot October 1 (discharge, 88 second-feet).

1906–1916: Maximum stage recorded, 8.2 feet March 18, 1907 (discharge, 14,600 second-feet); minimum stage, −0.1 foot July 2 and 3, 1912 (discharge, 18 second-feet).

Ice.—Stage-discharge relation slightly affected by ice.

Diversion.—Numerous diversions for Truckee Valley above and below station.

Regulation.—Flow affected somewhat by the operation of several power plants above the station, by storage at Lake Tahoe, and by the irrigation diversions for Truckee Valley.

Accuracy.—Stage-discharge relation permanent; presumably affected by ice January 16 to February 3. Rating curve well defined between 20 and 4,000 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except for period when stage-discharge relation was affected by ice. Records obtained by use of rating table good; others fair.

Discharge measurements of Truckee River at Reno, Nev., during the year ending Sept. 30, 1916.

[Made by L. W. Jordan.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 12	3.42	1,900	June 6	3.45	2,060
May 9	3.95	2,650	Aug. 5	1.22	255

Daily discharge, in second-feet, of Truckee River at Reno, Nev., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	182	368	368	....	880	2,190	2,730	1,310	660	324	213
2	107	182	368	368	....	880	2,320	3,030	1,310	805	417	182
3	107	182	368	660	....	880	2,320	3,030	1,220	730	471	182
4	154	182	660	417	471	1,410	2,320	3,520	1,720	660	417	182
5	107	213	368	471	530	1,510	2,730	3,870	1,830	660	368	182
6	129	213	368	530	471	1,410	2,730	4,440	2,070	660	368	182
7	129	182	324	471	530	1,410	3,030	3,520	2,070	660	324	182
8	129	247	368	471	660	1,410	3,030	2,880	2,070	660	284	129
9	107	284	368	530	595	1,510	3,520	2,730	2,190	660	324	154
10	107	324	324	530	1,040	1,610	3,870	2,450	2,070	530	324	154
11	107	284	368	530	1,040	1,830	5,020	2,320	1,950	530	324	182
12	107	247	324	471	730	1,950	3,190	2,190	1,720	530	284	284
13	129	284	324	471	595	2,320	2,450	1,950	1,720	530	182	247
14	107	284	417	595	595	2,320	2,730	1,830	1,720	471	247	182
15	107	324	324	530	595	2,190	3,190	1,830	1,830	417	284	182
16	107	284	284	530	595	2,450	3,030	1,830	2,070	417	247	182
17	107	284	368	....	595	2,190	3,190	1,830	2,070	368	213	182
18	129	324	324	....	595	2,320	2,450	1,950	1,830	324	247	213
19	129	324	284	....	595	2,590	2,190	2,070	1,610	247	247	213
20	154	324	284	....	595	3,870	2,190	1,830	1,510	213	213	182
21	154	368	368	....	660	3,520	2,450	2,070	1,220	213	247	182
22	213	368	368	....	960	2,880	2,590	2,070	1,040	182	129	213
23	182	368	368	....	960	2,590	2,730	1,950	1,040	182	247	247
24	247	324	324	....	960	1,950	3,030	1,720	1,040	182	247	247
25	213	368	284	....	960	1,720	3,030	1,310	1,130	182	247	182
26	213	368	324	....	960	1,610	3,350	1,040	1,040	182	213	213
27	182	368	324	....	960	1,830	3,520	960	960	182	213	213
28	182	284	368	....	960	1,950	3,690	1,040	1,040	417	213	247
29	154	368	368	....	960	2,320	3,190	1,220	1,040	417	247	213
30	182	368	368	....	....	2,450	2,880	1,220	730	324	247	247
31	182	....	368	....	....	2,190	....	1,310	....	324	247	....

NOTE.—Daily discharge for period when stage-discharge relation was affected by ice, estimated as follows: Jan. 17–31, 470 second-feet, and Feb. 1–3, 420 second-feet.

Monthly discharge of Truckee River at Reno, Nev., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	247	88	144	8,850
November	368	182	290	17,300
December	660	284	355	21,800
January	660	368	490	30,100
February	1,040	....	704	40,500
March	3,870	880	2,000	123,000
April	5,020	2,190	2,940	175,000
May	4,440	960	2,190	135,000
June	2,190	730	1,540	91,600
July	805	182	436	26,800
August	471	129	278	17,100
September	284	129	200	11,900
The year	5,020	88	962	699,000

TRUCKEE RIVER AT CLARK, NEV.

Location.—In SE. ¼ sec. 26, T. 20 N., R. 22 E., at highway bridge about 600 feet from Southern Pacific Railroad station at Clark, Storey County.

Drainage area.—1,740 square miles.

Records available.—July 1, 1907, to June 6, 1910; [1]August 1, 1910, to December 31, 1915; when the station was discontinued.

Gage.—Vertical staff on south abutment of bridge.

Discharge measurements.—Made from highway bridge.

Channel and control.—Bed composed of rock and gravel; shifts occasionally.

Extremes of discharge.—Maximum mean daily discharge, October to December, 1,080 second-feet, December 4.

1907–1915: Maximum mean daily discharge, 7,760 second-feet,[2] January 1, 1914; minimum mean daily discharge, 65 second-feet August 9, 1913.

Ice.—No information.

Diversions.—Water is used for irrigation in Truckee Valley above the station.

Regulation.—Flow affected by the operation of several power plants above the station and also by manipulation of the outlet gates of Lake Tahoe.

Cooperation.—Records furnished by the United States Reclamation Service.

Daily discharge, in second-feet, of Truckee River at Clark, Nev., for the period October to December, 1915.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	300	420	630	11	320	500	960	21	340	440	440
2	320	440	930	12	340	520	440	22	320	460	460
3	300	440	990	13	340	520	460	23	340	480	420
4	320	460	1,080	14	360	500	480	24	340	480	460
5	340	460	1,050	15	340	500	500	25	360	500	400
6	340	440	1,020	16	320	520	500	26	340	500	340
7	360	440	990	17	320	480	540	27	340	480	360
8	340	460	990	18	340	500	520	28	360	460	320
9	340	480	930	19	360	500	460	29	380	480	320
10	340	500	960	20	360	460	480	30	360	500	280
								31	380	......	240

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[1] Just above Derby dam, where the discharge is practically the same as at Clark.

[2] Discharge at Reno, March 18, 1907, 14,600 second-feet.

Monthly discharge of Truckee River at Clark, Nev., for the period October to December, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	380	300	341	21,000
November	520	420	477	28,400
December	1,080	240	611	37,600
The period				87,000

NOTE.—Monthly discharge table compiled by United States Geological Survey.

HONEY LAKE BASIN.

GOLD RUN CREEK NEAR SUSANVILLE, CAL.

Location.—In NE. ¼ sec. 17, T. 29 N., R. 12 E., at bridge on county road at Ridenour & Sons' ranch, about 2½ miles southeast of Susanville, Lassen County, Cal.

Drainage area.—Not measured.

Records available.—February 24 to March 31, 1913, and March 21, 1915, to June 8, 1916 (not complete), when the station was discontinued.

Gage.—Vertical staff nailed to upper side of right bridge abutment; read by S. D. Ridenour. Gage used in 1913 was at same location but different datum.

Discharge measurements.—By wading or from bridge.

Channel and control.—Gravel and small boulders; subject to shift.

Extremes of stage.—1913–1916: Water above gage May 11, 12, 1915, and February 10, 1916 (maximum discharge estimated 200 second-feet, Feb. 10, 1916); water below lower limit of gage (0.04 foot) most of October, all of November, and part of December, 1915 (discharge, less than 2.0 second-feet).

Ice.—Stage-discharge relation is affected by ice for short periods.

Diversions.—No information.

Regulation.—No information.

Accuracy.—Stage-discharge relation not permanent. Affected by ice December 30, 31, and January 3 to 6; also by back water due to operation of head gates of an irrigation ditch which heads between the gage and control. See footnote to daily-discharge table. Base rating curve fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Gold Run Creek near Susanville, Cal., during the year ending Sept. 30, 1916.

[Made by Thad McKay.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Feb. 19	1.16	25
Mar. 26	1.16	26
May 17	[a] 1.26	22

[a] Stage-discharge relation probably affected by dam for irrigation.

Daily discharge, in second-feet, of Gold Run Creek near Susanville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	....	....	6.5	11	22	31	30	26
2	....	....	6.4	11	20	28	36	27
3	....	....	6.5	11	19	26	46	30
4	....	....	6.5	11	20	27	58	35
5	....	....	40	11	22	28	64	43
6	....	....	10	17	19	28	75	42
7	....	....	9.4	78	18	29	42	42
8	....	....	9.8	38	18	32	42	38
9	....	....	9.8	38	25	37	37	....
10	....	....	9.2	200	35	44	30	....
11	....	....	8.6	86	42	71	27	....
12	....	....	8.4	44	58	40	27	....
13	....	....	8.0	34	85	35	23	....
14	....	....	7.9	30	39	32	24	....
15	....	....	8.2	30	37	40	24	....
16	....	....	7.9	32	42	33	23	....
17	5.4	6.8	8.2	32	47	40	24	....
18	....	6.9	8.4	32	52	33	36	....
19	....	6.7	8.5	28	114	28	28	....
20	....	6.8	14.0	31	99	26	25	....
21	....	6.8	16	29	65	27	28	....
22	....	6.9	30	29	50	27	33	....
23	....	7.8	24	28	42	27	40	....
24	5.4	7.3	48	29	34	31	40	....
25	5.5	7.2	28	28	29	34	35	....
26	5.4	6.7	17	40	26	47	34	....
27	....	6.7	16	37	29	44	32	....
28	....	6.8	14	30	31	52	31	....
29	....	6.6	12	25	32	42	31	....
30	....	6.6	12	....	29	32	30	....
31	....	6.5	11	....	26	....	28	....

NOTE.—Water below lower limit of gage (discharge, 2.0 second-feet) Oct. 1-16, 18-23, and Oct. 27 to Dec. 16. Stage discharge relation affected by ice Dec. 30, 31, and Jan. 3 to 6; discharge estimated. Feb. 10, water above top of gage morning and evening; discharge estimated. Apr. 25 to May 1, backwater due to irrigation, about 0.5 foot; May 2-18, backwater, about 0.24 foot; May 19-22, backwater, about 0.86 foot; and June 8, backwater, about 0.6 foot. The daily gage height was modified by these amounts for backwater, before applying to the base rating table for conditions of no backwater.

Monthly discharge of Gold Run Creek near Susanville, Cal., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 17-31	7.8	6.5	6.87	204
January	48	6.4	13.9	855
February	200	11	37.2	2,140
March	114	18	39.5	2,430
April	71	26	35.1	2,090
May	75	23	35.1	2,160
June 1-8	43	26	35.4	562
The period	....	....	....	10,400

LASSEN CREEK NEAR SUSANVILLE, CAL.

Location.—In NW. ¼ sec. 22, T. 29 N., R. 12 E., at Drake ranch, about 4½ miles southeast of Susanville, Lassen County.

Drainage area.—Not measured.

Records available.—March 13 to April 14, 1913, and March 21, 1915, to June 7, 1916 (not complete), when the station was discontinued.

Gage.—Staff gage on right bank; read by Jesse Drake, jr. Gage used in 1913 was a staff gage nailed to bent of highway bridge 1½ miles downstream at independent datum.

Discharge measurements.—Made by wading.

Channel and control.—Composed of firm clay; changes frequently. Both banks subject to overflow at high water.

Extremes of stage.—Maximum stage recorded during year, 3.74 feet at 3.10 p. m. February 11; minimum stage recorded, 0.78 foot May 12.

Ice.—Stage-discharge relation probably affected by ice.

Diversions.—Water is diverted above the station for irrigation.

Regulation.—No information.

Accuracy.—Stage-discharge relation changes frequently. Sufficient measurements were not obtained to define the changes. Gage read to hundredths twice daily.

Discharge measurements of Lassen Creek near Susanville, Cal., during the year ending Sept. 30, 1916.

[Made by Thad McKay.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Feb. 19	1.46	9.2
Mar. 26	1.46	8.7

Daily gage height, in feet, of Lassen Creek near Susanville, Cal., for the year ending Sept 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		0.87	1.07	1.32	1.73	1.16	0.98
2		.88	1.08	1.30	1.51	1.09	.97
3		.93	1.08	1.28	1.62	1.09	1.00
4		.97	1.15	1.31	1.50	1.17	1.00
5		.98	1.06	1.36	1.50	1.14	.99
6		1.02	1.19	1.26	1.51	1.37	.99
7		1.04	1.47	1.31	1.50	1.26	1.04
8		1.20	1.55	1.23	1.52	1.07	
9		1.08	1.62	1.36	1.52	.94	
10		1.09	1.68	1.37	1.63	.89	
11		1.04	3.72	1.57	2.14	.85	
12		.98	2.04	1.54	1.69	.78	
13		.99	1.43	1.58	1.65	.82	
14		.99	1.38	1.57	1.55	.85	
15		1.18	1.29	1.48	1.63	.81	
16		1.11	1.45	1.60	1.60	.92	
17	1.07	1.04	1.44	1.56	1.89	.97	
18	1.05	1.11	1.46	1.82	1.62	1.09	
19	1.07	1.08	1.41	2.34	1.54	1.14	
20	1.06	1.03	1.51	2.34	1.46	1.12	
21	1.05	1.02	1.51	1.93	1.52	1.05	
22	1.07	1.07	1.45	1.53	1.46	1.04	
23	1.07	1.52	1.46	1.70	1.42	1.09	
24	1.06	2.02	1.53	1.58	1.40	1.05	
25	1.06	1.70	1.54	1.51	1.38	1.05	
26	.99	1.52	1.80	1.51	1.25	.99	
27	.99	1.37	2.20	1.74	1.31	1.05	
28	1.06	1.32	1.58	1.75	1.26	1.01	
29	.94	1.36	1.40	1.60	1.22	1.00	
30	.91	1.20		1.53	1.16	.96	
31	.85	1.11		1.47		.96	

BAXTER CREEK NEAR JANESVILLE, CAL.

Location.—In NE. ¼ SW. ¼ sec. 32, T. 29 N., R. 13 E., 200 feet west of bridge on county road at ranch of D. J. Sweeney, and 2½ miles northwest of Janesville, Lassen County.

Drainage area.—Not measured.

Records available.—February 17, 1913, to July 31, 1916, when the station was discontinued.

Gage.—Inclined staff on left bank, installed March 21, 1915; read by D. J. Sweeny. Original gage was 400 feet above; original datum not maintained.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Composed of gravel, small boulders and sand; somewhat shifting. An artificial control, effective at low stages, was constructed March 21, 1915, but its effect was destroyed by the changes produced by the flood of February 10, 1916. Zero flow was at stage 1.3 feet.

Extremes of stage.—Maximum stage recorded during year, 8.85 feet at 5 p. m. February 10; minimum stage recorded, 1.3 feet October 1 to November 3 (practically no flow).

1913-1916: Maximum stage recorded, 9.6 feet at 5 p. m. January 25, 1914 (discharge, 360 second-feet); minimum stage recorded, 1.3 feet (gage installed March 21, 1915) July 25 to November 3, 1915 (practically no flow).

Ice.—Stage-discharge relation affected by ice for short periods.

Diversions.—Small amount of meadow land irrigated above station.

Regulation.—No information.

Accuracy.—Stage-discharge relation changed frequently after January 5; observer's notes and record of stage indicate ice effect from about January 6 to 25 and from February 3 to 9. Rating curve, November 2 to January 5, fairly well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair up to January 5. Sufficient measurements were not obtained to define the changes in stage-discharge relation after January 5.

Discharge measurements of Baxter Creek near Janesville, Cal., during the year ending Sept. 30, 1916.

[Made by Thad McKay.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Feb. 6	3.40	20	Apr. 24	3.18	18
Mar. 26	2.70	14	May 17	2.91	23
Apr. 17	3.68	41			

Daily gage height, in feet, of Baxter Creek near Janesville, Cal., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.3	1.3	1.50	1.55	2.90	2.80	2.95	3.35	2.95	1.90
2	1.3	1.3	1.65	1.55	2.70	2.75	2.95	3.45	3.05	1.90
3	1.3	1.3	1.85	1.85	2.95	3.00	2.95	3.75	3.10	1.85
4	1.3	1.35	1.75	1.90	2.90	3.05	2.85	3.80	2.95	1.85
5	1.3	1.5	1.65	1.95	2.85	3.50	2.80	3.75	2.95	1.85
6	1.3	1.5	1.65	2.50	3.42	2.90	2.82	3.90	2.95	1.85
7	1.3	1.5	1.60	2.60	4.60	2.75	2.80	3.55	2.95	1.75
8	1.3	1.5	1.58	2.60	4.25	3.00	2.90	3.50	2.95	1.75
9	1.3	1.55	1.60	2.60	4.25	3.05	3.05	3.45	2.85	1.75
10	1.3	1.45	1.55	2.60	3.80	3.10	3.35	3.40	2.72	1.75
11	1.3	1.4	1.62	2.55	5.25	3.30	3.55	3.85	2.70	1.75
12	1.3	1.4	1.75	2.40	4.15	3.40	3.30	3.25	2.68	1.75
13	1.3	1.4	2.85	2.25	3.38	3.30	3.10	3.10	2.55	1.75
14	1.3	1.4	2.20	2.20	3.25	2.90	3.22	3.10	2.52	1.75
15	1.3	1.45	1.88	2.15	3.35	2.88	3.28	3.10	2.48	1.75
16	1.3	1.5	1.65	2.10	3.30	3.00	3.28	3.15	2.42	1.65
17	1.3	1.5	1.60	2.00	2.75	3.20	3.52	2.95	2.35	1.65
18	1.3	1.5	1.60	2.30	2.80	3.30	3.25	3.25	2.30	1.65
19	1.3	1.5	1.60	2.65	2.90	3.80	3.15	3.08	2.28	1.65
20	1.3	1.5	1.60	2.70	3.05	3.80	3.05	3.05	2.20	1.65
21	1.3	1.5	1.60	2.70	3.10	3.50	3.15	3.25	2.15	1.65
22	1.3	1.5	1.65	2.75	2.95	3.40	3.20	3.20	2.05	1.65
23	1.3	1.55	1.68	3.45	2.85	3.25	3.20	3.28	2.05	1.65
24	1.3	1.6	1.65	3.60	2.75	2.95	3.20	3.25	2.05	1.65
25	1.3	1.65	1.70	4.48	2.85	2.85	3.25	3.05	1.95	1.55
26	1.3	1.65	1.62	4.30	3.35	2.85	3.45	2.95	1.85	1.55
27	1.3	1.6	1.58	4.10	3.45	2.85	3.40	2.95	1.85	1.50
28	1.3	1.6	1.55	3.65	3.10	3.00	3.45	2.95	1.85	1.45
29	1.3	1.5	1.55	3.45	2.80	2.90	3.35	2.95	1.82	1.45
30	1.3	1.5	1.55	3.15	....	2.85	3.30	2.95	1.88	1.45
31	1.3	....	1.55	3.00	....	2.75	....	3.00	....	1.45

Daily discharge, in second-feet, of Baxter Creek near Janesville, Cal., for the period Oct. 1, 1915, to Jan. 5, 1916.

Day.	Nov.	Dec.	Jan.	Day.	Nov.	Dec.	Jan.	Day.	Nov.	Dec.	Jan.
1	......	1.0	1.4	11	0.4	1.9	......	21	1.0	1.7	......
2	......	2.2	1.4	12	.4	3.3	......	22	1.0	2.2	......
3	......	4.6	4.6	13	.4	24	......	23	1.4	2.5	......
4	0.2	3.3	5.3	14	.4	11	......	24	1.7	2.2	......
5	1.0	2.2	6.2	15	.7	5.0	......	25	2.2	2.7	......
6	1.0	2.2	......	16	1.0	2.2	......	26	2.2	1.9	......
7	1.0	1.7	......	17	1.0	1.7	......	27	1.7	1.6	......
8	1.0	1.6	......	18	1.0	1.7	......	28	1.7	1.4	......
9	1.4	1.7	......	19	1.0	1.7	......	29	1.0	1.4	......
10	.7	1.4	......	20	1.0	1.7	......	30	1.0	1.4	......
								31	......	1.4	......

NOTE.—No flow Oct. 1 to Nov. 3.

WARNER LAKES BASIN.

TWENTYMILE CREEK NEAR WARNER LAKE, OREG.

LOCATION.—In sec. 24, T. 40 S., R. 23 E., about a quarter of a mile above highway bridge at mouth of canyon, 2 miles south of Warner Lake post office, Lake County; below all tributaries.

DRAINAGE AREA.—155 square miles[1] (measured on U. S. Reclamation Service map). The total drainage area is 213 square miles, but an area of 58 square miles tributary to Cowhead Lake contributed no water to Twentymile Creek from about June 1, 1911, until the spring of 1914, none in 1915, and probably very little in 1914 or 1916.

RECORDS AVAILABLE.—March 1, 1910, to July 2, 1916, when station was discontinued.

GAGE.—Stevens continuous water-stage recorder on right bank beginning October 8, 1915; Barrett & Lawrence recorder, December 3, 1914, to October 8, 1915; gage reader, F. B. Houston. Original gage at bridge, March 1 to June 3, 1910; staff gage at site of present recorder, read June 3, 1910, to December 3, 1914, except March 31 to July 20, 1914, when a Barrett & Lawrence recorder, temporarily installed, was used. Gage readings during 1910 and 1911 refer to datum 0.32 foot higher than that used from 1912 to date.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading.

CHANNEL AND CONTROL.—Stream bed of boulders and gravel. Control is solid rock reef, broken by crevices, obstructions piled on this occasionally change discharge relation. A diversion dam installed about July 1 each year below highway bridge sometimes causes a slight backwater effect at gage. Banks not subject to overflow. Stage of zero flow, −0.2 foot ±.02.

EXTREMES OF DISCHARGE.—Maximum stage during year (estimated by observer from high-water marks), 6.4 feet March 14 or 15 (discharge, 1,130 second-feet); minimum stage recorded during year, 0.36 foot September 24 (discharge, 2.6 second-feet); this was probably very close to actual minimum.

1910–1916: Maximum stage recorded, 4.8 feet at original gage at bridge, March 1, 1910 (discharge, 2,610 second-feet). The peak may have been even higher. Minimum stage recorded, 0.26 foot August 30 and September 1, 1915 (discharge 1.8 second-feet).

ICE.—Ice forms in the stream but seldom at the control; stage-discharge relation not seriously affected; open-channel rating curve assumed applicable most of winter.

DIVERSIONS.—Some bottom land is irrigated along Fifteenmile and Twelvemile Creeks, and along Eightmile Creek, a tributary of Cowhead Lake. Two small ditches divert just above the station. There is also a ditch that diverts from the head of Twelvemile Creek into Lake Anne, a small storage reservoir in the north end of Surprise Valley.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined by measurements of 1915. Operation of water-stage recorder satisfactory from about February 5 to July 2, except during high water of March 13 to 25, when pencil did not reverse properly. Recorder in operation only part of time, October to January. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting gage-height graph or for days of large fluctuation, by averaging discharge obtained from gage heights for fractions of day. Records good, except for March, for which they are fair.

The following discharge measurement was made by Henshaw and Batchelder:

October 6, 1915: Gage height, 0.47 foot; discharge, 3.8 second-feet.

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[1] Revised since publication of Water-Supply Paper 390.

Daily discharge, in second-feet, of Twentymile Creek near Warner Lake, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.
1	3.5	4.7	5.8	4.0	a 7.0	27	156	102	67	31	......
2	a 3.5	5.0	7.7	a 4.2	a 8.0	26	109	101	67	31	......
3	a 3.6	5.2	8.9	a 4.5	a 8.0	22	91	98	70	......	......
4	a 3.6	5.6	12	a 4.7	a 9.0	22	90	115	84	......	......
5	a 3.7	a 5.6	8.4	a 5.0	a 10	25	72	123	101	......	......
6	3.7	a 5.7	7.4	a 5.2	12	21	63	126	95	......	......
7	a 3.7	a 5.7	7.1	a 5.5	16	23	65	106	92	......	......
8	a 3.6	a 5.8	6.4	5.7	18	77	69	94	91	......	......
9	3.6	5.8	6.1	a 5.8	18	204	77	84	97	......	......
10	a 3.6	a 5.7	a 6.2	a 5.9	70	306	87	76	90	......	......
11	a 3.6	a 5.6	6.4	a 6.0	116	370	134	68	76	......	......
12	a 3.5	a 5.5	6.5	a 6.2	98	525	84	62	71	......	......
13	a 3.5	a 5.4	a 6.6	a 6.3	82	675	63	a 63	68	......	......
14	3.5	a 5.3	a 6.7	a 6.4	79	760	63	a 64	66	......	......
15	3.7	5.2	a 6.9	6.5	98	760	72	a 65	67	......	......
16	4.0	6.8	a 7.0	a 6.5	116	385	a 71	a 66	70	......	......
17	4.0	5.7	a 7.1	a 6.6	130	410	a 70	a 67	69	......	......
18	4.0	6.5	7.2	a 6.6	112	510	a 69	a 68	70	......	......
19	3.9	6.2	a 7.2	a 6.7	98	615	a 68	a 69	67	......	......
20	3.8	6.0	a 7.3	a 6.7	97	a 530	a 67	70	60	......	......
21	4.0	6.4	a 7.4	a 6.8	112	a 450	a 66	76	52	......	......
22	4.0	6.2	a 7.5	6.8	116	a 370	a 65	73	44	......	......
23	4.2	6.0	a 7.6	11	88	a 290	a 64	73	39	......	......
24	4.6	6.1	a 7.7	13	83	a 210	63	76	36	......	2.6
25	4.6	7.1	7.7	13	80	126	73	73	35	......	......
26	a 4.6	10	a 7.2	a 11	108	156	82	109	34	......	......
27	a 4.6	6.8	a 6.6	a 9.0	123	230	95	87	34	......	......
28	a 4.6	a 6.6	a 6.1	a 7.0	56	270	97	71	32	......	......
29	a 4.7	a 6.3	a 5.6	6.0	36	137	87	73	32	......	......
30	a 4.7	a 6.1	a 5.1	a 6.0	......	94	91	69	31	......	......
31	a 4.7	......	a 4.5	a 7.0	......	98	......	70	......	......	......

a Discharge interpolated.

NOTE.—Daily discharge Mar. 13-24 estimated from imperfect gage-height graph and high watermark and is very uncertain. Discharge Jan. 29 estimated; stage-discharge relation slightly affected by ice.

Monthly discharge of Twentymile Creek near Warner Lake, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4.7	3.5	3.96	243
November	10	4.7	6.02	358
December	12	4.5	7.03	432
January	13	4.0	6.83	420
February	130	7.0	69.1	3,970
March	760	21	286	17,600
April	156	63	80.8	4,810
May	126	62	81.8	5,030
June	101	31	63.6	3,780
The period				36,600

DEEP CREEK AT ADEL, OREG.

Location.—In SE. ¼ sec. 21, T. 29 S., R. 24 E., just back of Wible's Hotel at Adel, Lake County, about one-eighth mile upstream from wagon bridge crossing creek; below all tributaries.

Drainage area.—250 square miles (measured on United States Reclamation Service map).

Records available.—May 11, 1909, to May 31, 1916, when station was discontinued.

Gage.—Barrett & Lawrence water-stage recorder, June 20 to September 30, 1914; March 19 to May 27, 1915; and March 7 to May 31, 1916. Friez recorder, March 10 to June 19, 1914; daily readings on vertical staff on left bank at other times; datum unchanged since 1913. Gage reader, W. S. Wible.

Discharge measurements.—Made from the wagon bridge or by wading.

Channel and control.—Probably permanent except for slight shifts affecting only low water; bed of stream composed of gravel and boulders; banks subject to overflow at both gage and bridge in extreme floods. Stage of zero flow, 2.0±.1 feet.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 5.7 feet at 3 a. m. March 12 and 5 a. m. March 19 (discharge, 1,180 second-feet); minimum stage recorded during year, 2.4 feet January 1 to 19 (very uncertain discharge estimated about 5 second-feet).

1909–1915: Maximum stage recorded, 9.0 feet at 6 p. m. March 2, 1910 (discharge, 4,950 second-feet); minimum stage recorded, 2.35 feet August 19 to 21 1915 (discharge, 2.0 second-feet).

Ice.—Stage-discharge relation probably not affected by ice.

Diversions.—Considerable area irrigated from tributaries and 2,000 or 3,000 acres watered by natural flooding in Big Valley and Crane Lake. Five ditches, with a total capacity of about 30 second-feet, divert water within 2 miles above the gage and carry some 5,000 acre-feet around the gage each year.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read once a day to half-tenths October 14 to January 28. Operation of water-stage recorder fairly satisfactory during period March to May except March 10, 11, and 24, when float was stuck, but record is subject to slight error, as staff gage was read only to nearest tenth. Daily discharge ascertained by applying to rating table the daily gage reading or the mean daily gage height obtained by inspecting the gage-height graph. Records fair October to January; good March to May. For February, poor.

The following discharge measurement was made by Henshaw and Batchelder:

October 6, 1915: Gage-height, 2.61 feet; discharge, 6.6 second-feet.

Daily discharge, in second-feet, of Deep Creek at Adel, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.
1	....	11	16	....	....	417	397
2	....	11	20	....	....	337	417
3	....	11	18	....	....	337	461
4	....	11	16	....	....	357	505
5	....	11	16	....	....	319	552
6	7	11	16	....	....	301	528
7	....	11	16	....	69	319	505
8	....	11	16	....	87	357	439
9	....	11	16	....	191	417	417
10	....	11	16	....	400	483	357
11	....	11	16	....	610	675	301
12	....	11	16	....	820	483	265
13	....	11	16	....	528	397	265
14	11	11	16	....	528	417	233
15	11	16	16	....	790	461	233
16	11	24	30	....	850	417	219
17	11	24	60	....	760	439	233
18	11	24	44	....	850	417	319
19	11	20	36	....	1,020	337	337
20	11	16	36	....	625	319	265
21	11	16	36	11	528	319	265
22	11	20	30	11	397	377	249
23	11	30	51	14	249	397	283
24	11	60	60	11	313	439	301
25	11	36	51	11	377	483	337
26	11	36	24	11	439	505	377
27	11	30	20	11	675	528	397
28	11	16	7	14	439	461	337
29	11	16	7	12	337	417	319
30	11	16	7	12	301	397	265
31	11	....	6	12	357	....	265

Note.—Mean discharge estimated as follows: Oct. 1–5, 6 second-feet; Oct. 7–13, 9 second-feet; Jan. 1–20, 5 second-feet; Jan. 29–31, 12 second-feet; Mar. 1–6, 40 second-feet. Daily discharge interpolated Mar. 10, 11, and 24.

Monthly discharge of Deep Creek at Adel, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	11		9.6	590
November	60	11	18.5	1,100
December	60	6	24.2	1,490
January	14		7.4	455
February			[a] 80	4,600
March	1,020		412	25,300
April	675	301	411	24,500
May	552	219	343	21,100
The period				79,100

[a] Estimated from comparison with Twentymile Creek.

ABERT LAKE BASIN.

CHEWAUCAN RIVER AT DAM SITE NEAR PAISLEY, OREG.

Location.—In NW. ¼ sec. 10, T. 36 S., R. 18 E., a quarter of a mile below site of proposed reservoir dam of Paisley project of Northwest Townsite Co., half a mile below Little Swamp Creek, a mile below South Creek, and about 20 miles south of Paisley, Lake County.

Drainage area.—158 square miles (measured on map of Fremont National Forest).

Records available.—June 25, 1912, to September 2, 1914 (fragmentary); September 3, 1914, to October 31, 1916, when station was discontinued.

Gage.—Stevens 8-day water-stage recorder installed May 26, 1915. Vertical staff on right bank used previously. Gage reader, F. M. Beane.

Discharge measurements.—Made from cable 20 feet below gage or by wading.

Channel and control.—Gravel and boulders; fairly permanent.

Extremes of discharge.—Maximum stage during year, from water-stage recorder, 3.36 feet at 2 a. m. May 5, and 3 a. m. May 6 (discharge, 594 second-feet); minimum stage, from water-stage recorder, 0.54 foot at 5 a. m. December 10 (discharge, 8 second-feet; low stage caused by freezing of the river above, which temporarily held back the water.)

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—None.

Regulation.—No artificial regulation; considerable diurnal fluctuation during spring flood and first few days of freezing weather in the fall.

Accuracy.—Stage-discharge relation practically permanent; slight shift affecting only low water occurred during high water. Two well-defined rating curves used which are identical above gage-height 1.5 feet. Operation of water-stage recorder satisfactory except during winter. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph; records for ice period based mostly on meter measurements. Records excellent except for period when stream was affected by ice, for which they are fair.

Cooperation.—Field data furnished by Northwest Townsite Co.

Discharge measurements of Chewaucan River at dam site near Paisley, Oreg., during the period October, 1915, to November, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Dec. 15	Daniels and Beane	1.04	24.9	Mar. 9	F. M. Beane	1.39	72
23	F. M. Beane	1.23	55	13	W. S. Daniels	2.15	203
				18	F. M. Beane	2.42	258
1916.				26	do	1.87	151
Jan. 15	do	1.51	31.2	Apr. 5	Daniels and Beane	2.10	189
29	do	1.59	37.6	9	F. M. Beane	2.42	261
Feb. 8	do	1.72	42.4	May 4	W. S. Daniels	3.07	480
15	do	1.49	57	June 24	do	1.95	160
22	do	1.50	86	Oct. 10	do	1.00	31.3
Mar. 1	do	1.30	64	Nov. 10	do	1.31	63

Daily discharge, in second-feet, of Chewaucan River at dam site near Paisley, Oreg., for the period Oct. 1, 1915, to Oct. 31, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	25	28	43		62	200	398	260	152	40	31	
2	25	28	47		[a] 60	190	415	248	142	40	31	
3	26	30	58		[a] 60	190	450	260	127	40	31	
4	26	30	55		59	200	530	290	118	39	31	
5	26	29	45		60	190	550	320	109	39	33	
6	26	23	52		[a] 64	200	570	335	108	39	34	
7	26	24	50		[a] 68	222	490	335	99	39	32	
8	26	29	46	42	71	248	450	335	93	38	31	
9	26	27	41		75	275	432	350	89	38	31	
10	26	28	28		104	320	[a] 376	350	86	39	31	31
11	26	36			92	335	320	320	81	38	31	31
12	26	24			138	290	311	305	77	40	31	31
13	26				186	275	293	260	76	39	31	31
14	26				154	305	275	260	72	39	31	31
15	26		25	57	180	320	275	248	71	38	30	30
16	25			[a] 67	210	350	290	260	68	38	30	30
17	25			77	222	320	305	260	81	43	30	30
18	26			74	255	290	350	248	76	[a] 41	30	30
19	26	45			305	248	335	222	68	[a] 39	30	30
20	26	42			335	235	320	222	62	[a] 38	30	30
21	26	50			275	248		210	59	37	30	31
22	26			86	235	275		190	56	37	30	30
23	29		53		200	275		170	54	36	30	28
24	32		51		190	[a] 312		160	53	34	30	30
25	29		54		166	350		154	51	34		31
26	29				160	415		154	51	33		31
27	29	43			200	450	290	156	50	33		30
28	28	48			190	432	275	146	49	32		28
29	28	49		64	168	380	260	140	45	31		28
30	28	42			160	380	260	154	42	31		32
31	28				168		275		41	31		31

[a] Interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 13–16, Dec. 11–19, and Dec 26, to Feb. 16; daily discharge for these periods estimated only for days for which record is available, from observer's notes and records of temperature. Mean discharge estimated as follows: Nov. 13–18, 30 second-feet; Nov. 22–26, 40 second-feet; Dec. 11–14, 25 second-feet; Dec. 16–22, 45 second-feet; Dec. 26, to Feb. 7, 30 second-feet; Feb. 9–14, 50 second-feet; Feb. 19–21 and 23–28, 80 second-feet; May 21-26, 305 second-feet; Sept. 25-30, 30 second-feet; Oct. 1–9, 31 second-feet. Daily discharge interpolated Mar. 2, 3, 6, 7, Apr. 24, May 10, and Aug. 18–20.

Monthly discharge of Chewaucan River at dam site near Paisley, Oreg., for the period Oct. 1, 1915, to Oct. 31, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	32	25	26.7	1,640
November	50	23	34.5	2,050
December	58	25	40.1	2,470
January			[a] 30.0	1,840
February			58.5	3,360
March	335	59	157	9,650
April	450	190	291	17,300
May	570	260	352	21,600
June	350	140	244	14,500
July	152	41	77.5	4,770
August	43	31	37.2	2,290
September	34	30	30.7	1,830
The year	570		115	83,300
October	32	28	30.5	1,880

[a] Estimated.

CHEWAUCAN RIVER NEAR PAISLEY, OREG.

Location.—In SW. ¼ sec. 27, T. 33 S., R. 18 E., just above mouth of Mill Creek, half a mile above intake of Conn ditch and about 2½ miles upstream from Paisley, Lake County.

Drainage area.—263 square miles (measured on map of Fremont National Forest).

Records available.—January 20, 1914, to September 30, 1916. Records giving practically the same yearly run-off are available, as follows: Chewaucan River above Mill Creek, near Paisley, Oreg. (Geological Survey gage), November 6, 1912, to September 30, 1914; Chewaucan River above Conn ditch, near Paisley, Oreg., April 3 to July 13, 1912; Chewaucan River at Paisley, Oreg., January 4, 1905, to December 31, 1907, and January 18, 1909, to April 15, 1912.

Gage.—Lietz water-stage recorder, belonging to Chewacan Land & Cattle Co., on left bank, known as ZX gage, about 50 feet above Geological Survey gage; inspected by A. A. Farrow. Stevens 8-day water-stage recorder, belonging to Northwest Townsite Co., on left bank, May 1 to September 30, 1916, referred to vertical staff known as Geological Survey gage; inspected by W. S. Daniels. Both gages are referred to same datum, but slope of water surface causes a slight difference in comparative readings.

Discharge measurements.—Made by wading or from cable between the two recorders; fairly good section.

Channel and control.—Bed composed of gravel and boulders. Control the same for both gages; just above Mill Creek; composed of boulders and shifts slightly during floods.

Extremes of discharge.—Maximum stage during year from ZX water-stage recorder, 3.15 feet May 5 (discharge, 730 second-feet); minimum stage from ZX water-stage recorder, 0.45 foot November 7 (discharge, 10 second-feet).

1905–1907 and 1909–1916: Maximum stage recorded on old gage one-half mile above Paisley, 9.40 feet at 5 p. m. November 23, 1909 (discharge estimated from extension of rating curve, 4,000 second-feet); minimum discharge is that of 1916.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—Not over two or three hundred acres are irrigated above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent; rating curves for both gages revised slightly on basis of measurements made in 1916 and are well defined. Operation of both recorders satisfactory except the ZX gage for period March 22 to 30. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Records excellent except for periods when stream was frozen, for which they are fair.

Cooperation.—Field data furnished by Chewacan Land & Cattle Co. and Northwest Townsite Co.

Discharge measurements of Chewaucan River near Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	U. S. G. S. gage height.	ZX gage height.	Discharge.	Date	Made by—	U. S. G. S. gage height.	ZX gage height.	Discharge.
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
Oct. 24	Bert Harber[a]	....	0.95	42.4	Apr. 17	W. S. Daniels	2.59	2.65	445
Nov. 18	.....do	....	.95	41.5	24	Bert Harber	2.62	2.70	437
Dec. 14	Daniels and Greenslet[b]	....	.84	33.9	26	W. S. Daniels	2.81	2.90	625
23	Bert Harber	....	[b] 1.25	63.4	May 10	.....do	2.62	2.68	464
Jan. 24	.....do	....	[c] 1.55	52.2	22	.....do	2.46	2.55	392
26	E. R. Greenslet	....	[c] 1.35	36.0	26	Bert Harber	2.40	2.50	329
Feb. 28	Bert Harber	....	[c] 1.25	69.6	June 17	.....do	2.32	2.35	316
Mar. 7	Daniels and Greenslet	....	1.03	50.1	27	W. S. Daniels	1.84	1.90	190
16	W. S. Daniels	....	2.18	277	July 10	.....do	1.35	1.39	95.0
20	Bert Harber	....	2.80	498	28	Bert Harber	1.04	1.05	54.1
Apr. 11	W. S. Daniels	2.71	2.79	497	Aug. 1	W. S. Daniels	.98	1.03	47.8
					Sept. 16	.....do	.82	....	32.0

[a] Employee of Chewacan Land & Cattle Co.
[b] Employees of Northwest Townsite Co.
[c] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Chewaucan River near Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	26	28	44	46	25	83	250	490	330	178	48	33
2	27	28	59	46	26	75	244	520	310	172	47	32
3	25	28	58	46	33	75	210	580	310	152	46	36
4	25	32	64	37	37	79	199	645	330	137	46	38
5	25	31	47	37	37	76	210	715	350	126	48	39
6	25	25	57	46	42	59	227	715	372	120	46	41
7	26	20	56	46	54	76	330	645	372	112	43	38
8	25	25	50	46	63	80	392	590	395	106	42	36
9	26	27	46	37	63	114	379	550	418	102	43	35
10	26	27	32	37	114	164	415	465	418	97	42	36
11	26	38	40	37	106	206	492	418	395	91	41	36
12	26	33	36	37	98	259	406	395	350	87	48	36
13	27	26	55	37	95	232	370	372	330	84	48	35
14	28	30	42	37	95	222	350	350	330	80	47	34
15	29	33	33	46	109	262	440	350	310	78	44	33
16	27	36	29	46	120	370	406	350	330	75	44	32
17	26	44	42	46	130	392	384	372	310	92	49	31
18	25	43	52	46	135	440	330	440	310	90	53	30
19	27	43	57	46	125	520	323	418	275	77	49	30
20	29	46	76	46	124	550	280	395	245	73	45	30
21	33	46	98	46	120	392	274	395	245	68	44	30
22	34	41	83	46	127	350	323	372	220	64	42	30
23	36	48	57	46	116	290	323	395	195	61	41	30
24	40	44	42	57	111	230	430	395	184	59	39	31
25	35	41	57	63	111	232	492	395	178	57	37	31
26	33	34	23	52	118	233	530	372	174	57	37	32
27	31	42	33	45	118	235	610	372	184	57	36	32
28	29	34	69	38	88	210	610	350	168	56	36	32
29	31	83	69	31	80	205	520	330	156	54	37	32
30	30	58	29	25	....	200	509	330	168	51	36	32
31	29	....	37	24	....	210	....	330	....	49	35	....

Note.—Record, Oct. 1 to Apr. 30 from ZX gage; May 1 to Sept. 30 from Geological Survey gage. Daily discharge Mar. 24 and 30 determined from readings on Survey gage. Stage-discharge relation affected by ice Nov. 14, 15, Dec. 15 to Feb. 12; discharge estimated from gage heights, discharge measurements, observer's notes, and weather records.

Monthly discharge of Chewaucan River near Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	40	25	28.6	1,760
November	83	20	37.1	2,210
December	98	23	50.7	3,120
January	63	24	42.6	2,620
February	135	25	90.3	5,190
March	550	59	230	14,100
April	610	199	375	22,300
May	715	330	445	27,400
June	418	156	289	17,200
July	178	49	89.1	5,480
August	53	35	43.2	2,660
September	41	30	33.4	1,990
The year	715	20	146	106,000

CHEWAUCAN RIVER AT NARROWS, NEAR PAISLEY, OREG.

Location.—In the NE. ¼ sec. 24, T. 34 S., R. 19 E., at a constriction in Chewaucan Marsh known as The Narrows, one-eighth mile below the lower end of outside canal and 12 miles southeast of Paisley, Lake County. Moss Creek enters upper marsh but seldom contributes any water to the river.

Drainage area.—Not measured.

Records available.—January 18, 1914, to September 30, 1916.

Gage.—Chewacan Land & Cattle Co. (ZX) gages: January 18, 1914, to March 23, 1916, vertical staff on left bank on old channel, in NW. ¼ sec. 19, T. 34 S., R. 20 E.; March 24 to September 30, 1916, vertical staff on left bank just below outlet of outside canal. Gage reader W. W. Hampton.

Northwest Townsite Co. gages: Used ZX gage January 18, 1914, to March 25, 1916; March 27 to June 3, vertical staff about one-fourth mile below original ZX gage; June 3 to August 19, vertical staff just east of original ZX gage, in backwater of dredging operations; August 19 to September 30, vertical staff on right bank just below highway bridge, which was erected in 1916. Gage reader, Mrs. B. A. Webster.

Discharge measurements.—Made by wading at low and medium stages; at high water, from plank projecting from a wagon drawn across river by a horse on shore, or from a boat.

Channel and control.—At original ZX gage up to March 23, and at Northwest Townsite Co. gage March 27 to June 3, natural channel of gravel; somewhat shifting. At ZX gage beginning March 24 and at Northwest Townsite Co. gages beginning June 3, dredged canal, fairly permanent, but stage-discharge relation affected by dredging operations below until about August 18, after which time it was fairly stable.

Extremes of discharge.—Maximum stage recorded during year, 3.8 feet on ZX gage, 3.05 feet on second Northwest Townsite Co. gage, May 10 (discharge, 366 second-feet); minimum stage recorded, 0.8 foot October 7 and 8 (discharge, 6 second-feet).

1914–1916: Maximum stage recorded, 3.50 feet April 20, 21, and 24, 1914 (discharge, 505 second-feet); minimum stage recorded, 0.22 foot September 8–10 1915 (channel dry).

Ice.—Stage-discharge relation affected for short periods; ice effect less severe than usual, as dredge was working just above station and flow was regulated sufficiently to keep shore ice loosened and flushed out.

Diversions.—About 6,200 acres of uplands and 14,300 acres of marsh hay land are irrigated between the station above Paisley and this station.

Regulation.—Discharge varies considerably owing to the manipulation of dams and ditches used for irrigating marsh and bordering lands and to operation of dredge, which was cutting a new channel for the river and approaching the gage from above until about the middle of March.

Accuracy.—Stage-discharge relation at original ZX gage changed in December; unstable after March 15; at second ZX gage unstable until August 18; at Northwest Townsite Co. gages fairly permanent. A number of well-defined and fairly well defined rating curves were developed for the various periods of records. ZX gages read once daily to half-tenths by W. W. Hampton and, until March 25, three times a week to hundredths by Mrs. Webster; mean of readings used when both observers visited the gage the same day. Northwest Townsite Co. gages read three times a week to hundredths. Daily discharge ascertained by applying to rating table the mean daily gage height and by indirect method for shifting control. Records good except for January and March, for which months they are fair.

Cooperation.—Part of discharge measurements and gage readings furnished by Chewacan Land & Cattle Co., W. C. Hammatt, engineer, and part by the Northwest Townsite Co.

Discharge measurements of Chewaucan River at Narrows, near Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.					Discharge.
		Original ZX gage.	Second ZX gage.	First Northwest Townsite Co. gage.	Second Northwest Townsite Co. gage.	Gage at bridge.	
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
Oct. 20	W. S. Daniels [a]	0.97					16.0
26	Bert Harber [b]	1.05					20.1
Nov. 5	W. S. Daniels	1.10					25.7
19	Bert Harber	1.25					43.5
Dec. 3	W. S. Daniels	1.23					41.3
28	Bert Harber	.95					18.8
29	E. R. Greenslet [a]	1.11					31.9
Jan. 26	Bert Harber	1.15					46.3
28	E. R. Greenslet	1.46					46.7
Feb. 17	do	1.40					96
25	Bert Harber	1.40					79
Mar. 8	W. S. Daniels	1.22					59
24	Bert Harber		3.00				127
Apr. 4	Daniels & Beane		[c] 3.00	2.49			226
12	W. S. Daniels		[c] 3.55	2.96			331
25	Bert Harber		3.20				265
28	W. S. Daniels		[c] 3.20	2.93			336
May 9	do		[c] 3.75	3.00			351
20	do		[c] 2.90	2.67			267
27	Bert Harber		1.55	[c] 2.28			103
June 3	W. S. Daniels		[c] 1.25	1.47	2.47		126
15	do		[c] .50		1.64		119
19	Bert Harber		.45		[c] 1.62		107
29	W. S. Daniels		[c] .25		1.38		98
July 13	do		[c] −.40		.70		62
25	do		[c] −1.25		−.21		31.6
29	Bert Harber		−1.55		[d] −.57		20.6
Aug. 5	W. S. Daniels		[c] −1.50		−.50		19.2
18	Bert Harber		−1.65				21.5
19	Daniels & Finch		[c] −1.25		−.56	1.00	39.9
22	do		[c] −1.45			.83	32.2
Sept. 11	W. S. Daniels		[c] −1.70			.53	17.2
21	F. F. Henshaw		[c] −1.80			.47	12.9

[a] Employee of Northwest Townsite Co.

[b] Employee of Chewaucan Land & Cattle Co.

[c] Observer's reading for day.

[d] Observer's reading for previous day.

Daily discharge, in second-feet, of Chewaucan River at Narrows, near Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	22	22	33	9	24	38	182	308	130	106	33	18
2	17	22	60	12	24	31	211	261	126	109	32	18
3	10	26	50	12	24	46	208	214	126	108	29	18
4	10	26	68	38	24	46	228	242	129	114	28	18
5	10	26	44	25	24	55	211	270	132	138	20	18
6	11	26	50	24	31	46	205	283	134	129	18	18
7	12	17	44	24	46	46	199	295	138	111	16	18
8	12	22	54	31	52	57	226	308	144	98	18	18
9	6	26	51	38	46	38	254	355	145	91	21	18
10	6	19	33	38	65	55	282	366	140	82	18	18
11	33	14	26	38	135	85	316	333	136	73	18	18
12	17	40	26	24	95	155	350	304	130	66	17	19
13	14	22	66	31	95	185	308	280	123	62	17	20
14	17	17	51	31	99	145	329	258	115	60	17	20
15	16	32	38	24	95	139	350	240	114	57	18	18
16	17	32	32	24	97	160	329	232	111	55	18	17
17	17	33	32	24	95	180	308	224	112	54	18	15
18	16	44	26	24	91	180	302	250	111	54	23	14
19	17	45	22	24	85	230	295	298	112	52	40	12
20	17	44	26	24	85	260	222	264	106	50	37	10
21	14	37	55	24	97	230	226	222	104	50	34	12
22	14	45	89	24	95	160	231	180	100	38	31	16
23	17	51	95	38	99	140	235	163	98	34	22	15
24	17	45	65	38	95	127	240	217	94	31	20	13
25	22	26	52	38	79	141	268	225	92	28	20	12
26	22	37	38	46	85	156	295	167	91	27	20	13
27	24	28	30	38	95	170	308	148	92	25	20	16
28	26	17	20	46	75	170	320	140	94	20	20	16
29	22	28	32	31	46	171	316	126	98	20	20	16
30	22	44	24	31	......	162	312	131	94	30	20	16
31	17	......	11	24	......	154	......	128	......	33	20	......

NOTE.—Daily discharge computed from records at ZX gage Oct. 1 to Mar. 26; from records at Northwest Townsite Co. gage Mar. 27 to May 8, and from the means of the two records May 9 to Sept. 30. The two records disagree materially for period May 26–29 only; during this time it is probable that some water temporarily ponded by the operation of the dredge was being released. Stage-discharge relation affected by ice Dec. 29–31, Jan. 6–7, 10–23, Jan. 27 to Feb. 6, and Feb. 22 to Mar. 2; daily discharge estimated from discharge measurements, observer's notes, and temperature records.

Monthly discharge of Chewaucan River at Narrows, near Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	33	6	16.6	1,020
November	51	14	30.4	1,810
December	95	11	43.3	2,660
January	46	9	28.9	1,780
February	135	24	72.3	4,160
March	260	31	128	7,870
April	350	182	269	16,000
May	366	126	240	14,800
June	145	91	116	6,900
July	138	20	64.7	3,980
August	40	16	22.6	1,390
September	20	10	16.3	970
The year	366	6	87.1	63,300

CHEWAUCAN RIVER AT HOTCHKISS FORD, NEAR PAISLEY, OREG.

Location.—At a river crossing known as Hotchkiss Ford, near line between secs. 11 and 12, T. 35 S., R. 20 E., below lower Chewaucan Marsh, above Crooked Creek, and about 20 miles southeast of Paisley, Lake County. Willow Creek enters lower marsh but contributes water to it only during the early spring floods, the entire flow at other times being diverted for irrigation.

Drainage area.—Not measured.

Records available.—January 18, 1914, to September 30, 1916.

Gage.—Vertical staff on left bank. Gage readers, W. W. Hampton for Chewacan Land & Cattle Co., and Mrs. B. A. Webster for Northwest Townsite Co.

Discharge measurements.—Made by wading.

Channel and control.—Bed composed of fine gravel, sand, and mud; channel somewhat shifting. Growth of aquatic plants, mostly tules, affects stage-discharge relation most of the year. Banks low and river widens considerably at high stages.

Extremes of discharge.—Maximum stage recorded during year, 3.8 feet, May 26 and 27 (discharge, 260 second-feet); minimum stage recorded, 1.05 feet October 1 (discharge, 3.0 second-feet).

1914–1916: Maximum stage recorded, 4.50 feet April 24, 1914 (discharge, 400 second-feet); minimum stage recorded, 0.9 foot September 6, 1915; stream bed practically dry September 7 to 17, 1915.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—About 7,800 acres of marsh hay land are irrigated between the Narrows and Hotchkiss Ford stations. A total of 28,300 acres is watered from the river above the station.

Regulation.—Discharge may vary during irrigating season owing to manipulation of dams and ditches for irrigating the marsh.

Accuracy.—Stage-discharge relation unstable owing to growth of aquatic plants, except August 9 to Setpember 30, when a well-defined rating curve was used. Gage read once daily to half-tenths by Chewacan Land & Cattle Co., and three times a week to hundredths by Northwest Townsite Co. Mean of two readings used for days when both observers visited gage. Daily discharge ascertained by applying to rating table the mean daily gage height, August 9 to September 30, and by shifting-control method the rest of year. Records good except for ice periods of December and January, for which they are only fair.

Cooperation.—Part of field data furnished by Chewacan Land & Cattle Co., through W. C. Hammatt, consulting engineer, and part by Northwest Townsite Co.

Discharge measurements of Chewaucan River at Hotchkiss Ford, near Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	W. S. Daniels[a]	1.28	14.6	Apr. 28	W. S. Daniels	2.44	157
26	Bert Harber[b]	1.30	18.4	May 9	do	2.96	187
Nov. 5	W. S. Daniels	1.34	20.0	20	do	3.72	242
19	Bert Harber	1.45	41.9	28	Bert Harber	3.70	246
Dec. 3	W. S. Daniels	1.51	39.0	June 3	W. S. Daniels	2.90	114
28	Bert Harber	1.40	43.8	15	do	2.80	71
29	E. R. Greenslet[a]	1.60	25.3	20	Bert Harber	2.85	98
Jan. 27	Bert Harber	1.75	26.5	29	W. S. Daniels	2.90	66
28	E. R. Greenslet	1.66	32.6	July 13	do	3.20	80
Feb. 17	do	1.85	103	25	do	2.15	25.8
25	Bert Harber	1.80	92	29	Bert Harber	1.75	17.5
Mar. 8	W. S. Daniels	1.65	63	Aug. 5	Daniels and Finch	1.35	13.6
23	Bert Harber	1.95	104	17	Bert Harber	1.30	14.4
27	W. S. Daniels	1.50	59	19	W. S. Daniels	1.26	12.6
Apr. 12	do	2.60	183	Sept. 11	do	1.26	11.6
26	Bert Harber	2.15	104	21	F. F. Henshaw	1.19	8.7

[a] Employee of Northwest Townsite Co.

[b] Employee of Chewacan Land & Cattle Co.

Daily discharge, in second-feet, of Chewaucan River at Hotchkiss Ford, near Paisley, Oreg. for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.0	19	38	28	38	90	156	212	140	67	14	12
2	7.0	19	38	32	38	72	150	212	125	67	14	12
3	9.0	19	39	32	42	72	154	206	114	80	14	12
4	9.0	19	38	32	50	72	189	200	105	105	15	12
5	7.0	20	50	32	54	67	200	182	103	120	14	12
6	9.0	22	50	35	67	67	189	172	95	130	14	12
7	9.0	28	50	35	76	58	162	167	87	120	14	12
8	9.4	28	50	35	80	63	145	177	80	129	14	12
9	9.0	28	46	35	85	54	135	187	80	125	15	12
10	7.0	32	46	35	76	54	138	206	76	110	14	12
11	7.0	32	46	35	96	58	162	206	72	100	14	12
12	11	32	42	38	95	72	183	218	67	93	14	12
13	16	38	35	38	105	96	194	218	72	80	14	12
14	16	38	38	35	100	115	194	218	67	72	14	12
15	16	38	38	28	100	110	185	212	71	67	14	12
16	14	42	42	28	100	100	167	212	74	58	14	12
17	14	42	35	28	100	113	178	200	80	57	14	12
18	14	42	42	28	100	140	178	212	85	54	14	12
19	14	42	42	28	100	162	172	237	95	54	12	12
20	15	42	35	28	100	184	156	242	96	50	14	9
21	14	46	42	28	100	200	143	242	95	46	18	9
22	14	46	46	28	105	178	145	231	90	42	18	9
23	14	42	58	38	100	104	120	230	80	38	18	9
24	14	42	58	38	100	82	110	230	76	34	18	9
25	17	50	56	38	92	76	105	235	76	28	18	9
26	18	42	54	32	90	73	104	260	71	25	18	9
27	21	42	50	26	95	59	115	260	72	22	14	9
28	22	42	44	33	95	80	157	246	70	18	12	12
29	22	35	25	38	85	137	178	212	66	18	12	12
30	22	35	25	38	....	156	194	184	62	16	12	12
31	22	....	16	38	....	150	....	156	....	14	12	....

NOTE.—Stage-discharge relation affected by ice Nov. 10, 11, 13–17, 28, Dec. 1, 2, 11, 14–20, 26, 27, Jan. 29 to Feb. 2, Feb. 28 to Mar. 4, daily discharge ascertained from discharge measurements, observer's notes, and weather records. Daily discharge interpolated Sept. 7 and 9.

Monthly discharge of Chewaucan River at Hotchkiss Ford, near Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	22	3.0	13.4	824
November	50	19	34.8	2,070
December	58	16	42.4	2,610
January	38	26	32.9	2,020
February	105	38	85.0	4,890
March	200	54	100	6,150
April	200	104	159	9,460
May	260	156	212	13,000
June	140	62	84.8	5,050
July	130	14	65.8	4,050
August	18	12	14.5	892
September	12	9	11.2	666
The year	260	3	71.3	51,700

CONN DITCH NEAR PAISLEY, OREG.

Location.—In SE. ¼ sec. 27, T. 33 S., R. 18 E., just below road crossing, half a mile below intake of ditch, and about 2 miles southwest of Paisley, Lake County.

Records available.—July 17, 1914, to September 30, 1916.

Gage.—Vertical staff (ZX gage) owned by Chewacan Land & Cattle Co., on left or upper side of ditch about 40 feet below road bridge; also Northwest Townsite Co. vertical staff 20 feet upstream. Gage readers, A. A. Farrow (ZX gage) and W. S. Daniels (Townsite Co. gage).

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Ditch not particularly well built or maintained; control somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 1.64 feet on Northwest Townsite Co. gage, May 11 (discharge, 13 second-feet).

1914–1916: Maximum stage recorded, 1.75 feet July 20, 1914 (discharge, 19 second-feet). Canal dry at times.

Ice.—Water generally turned out of canal during extremely cold weather.

Accuracy.—Stage-discharge relations for both gages not permanent. ZX gage read daily to half-tenths; Northwest Townsite Co. gage about three times a week to hundredths. Daily discharge ascertained by applying daily gage readings to rating table. Records fair.

Cooperation.—Most of the gage readings and meter measurements furnished by the Chewacan Land & Cattle Co., W. C. Hammatt, consulting engineer, and some by the Northwest Townsite Co.

Conn ditch diverts from Chewaucan River in the S. E. ¼ sec. 27, T. 33 S., R. 18 E., about three-eighths mile below Mill Creek and the gaging station just above it. The water is used for irrigating 600 acres of the Conn ranch on a bench northwest of Paisley.

Discharge measurements of Conn ditch near Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.	Date.	Made by—	Gage height.		Discharge.
		ZX gage.	N. T. Co. gage.				ZX gage.	N. T. Co. gage.	
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
Oct. 24	Bert Harber [a]	0.35		0.5	July 28	Bert Harber	1.30	1.29	8.5
May 12	W. S. Daniels [b]		0.96	3.0	Aug. 1	W. S. Daniels		1.35	9.2
22	do		.42	.6	3	do	[c] 1.10	1.16	6.7
June 17	Daniels and Finch		1.30	10.7	16	Bert Harber	1.15		8.6
18	Bert Harber	1.25	1.30	8.8	23	W. S. Daniels	[c] .95	1.00	4.8
July 3	W. S. Daniels		1.02	6.3	Sept. 22	F. F. Henshaw	.82	.84	3.5

[a] Employee of Chewacan Land & Cattle Co.
[b] Employee of Northwest Townsite Co.
[c] Observer's reading for day.

Daily discharge, in second-feet, of Conn ditch near Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	0.7	0.3	....	0.2	0.2	8.5	9.3	0.3
2	2.2	.3	.3	....	.2	.2	7.4	8.0	2.0
3	2.2	.3	.3	....	.2	.3	6.3	6.7	3.8
4	2.0	.3	.4	....	.2	.4	6.0	6.8	3.8
5	2.2	.3	.3	....	.2	.5	7.2	6.4	3.8
6	2.2	.3	.3	....	.2	.5	9.1	6.0	3.8
7	2.2	.3	.3	....	.2	.5	8.8	6.0	3.8
8	2.7	.3	.5	0.1	.1	.4	11.1	6.0	3.8
9	2.7	.3	.2	.1	.1	3.7	10.6	5.9	3.8
10	2.2	.3	.1	.1	.2	3.7	10.2	5.8	3.8
11	1.8	.2	.3	.1	13	3.6	9.2	5.6	3.8
12	3.0	.2	.2	.1	3.0	3.4	8.3	5.8	3.8
13	1.1	.1	.2	.2	2.7	3.3	8.8	5.4	3.2
14	2.7	.1	.2	.2	2.8	2.7	9.6	5.0	3.8
15	2.8	.1	.1	.2	3.0	3.2	9.0	8.5	4.3
16	2.7	.1	....	.2	3.1	10.7	8.5	6.7	3.8
17	2.2	.2	....	.2	3.1	10.7	9.4	6.8	3.8
18	2.2	.1	....	.2	1.9	8.8	10.4	1.4	3.8
19	1.4	.1	....	.2	.6	8.5	9.8	3.2	3.8
20	2.2	.1	....	.2	.6	8.2	9.3	4.9	3.8
21	1.3	.2	....	.2	.6	8.6	8.7	4.8	3.2
22	.2	.2	....	.3	.6	9.0	8.1	4.8	3.3
23	.4	.3	....	.3	.4	9.4	8.0	4.8	3.2
24	.5	.3	....	.3	.3	9.3	7.8	1.9	3.2
25	.3	.2	....	.3	.3	9.0	8.8	1.7	3.8
26	.2	.3	....	.2	.4	8.7	9.7	1.2	0
27	.1	.2	....	.2	.3	9.0	8.8	1.0	.1
28	.1	.2	....	.3	.3	8.7	8.5	.8	.1
29	.3	.3	....	.3	.3	9.2	8.9	.6	6.3
30	.2	.3	....	.2	.3	9.6	9.3	.5	6.3
31	1.0	....	....	....	.2	....	9.6	.4	....

NOTE.—Daily discharge ascertained as follows: Oct. 1 to Dec. 15, from gage readings on ZX gage and a fairly well defined rating curve; Apr. 11 to May 10, afternoon of May 18 to June 17, and July 1–25, from gage readings on Northwest Townsite Co. gage and a fairly well defined rating curve; May 11–17, estimated on account of obstruction caused by rock; June 18–30 and July 25 to Aug. 31, from gage readings on Northwest Townsite Co. gage and a rating curve well defined between 4 and 10 second-feet; Sept. 1–30, from readings on ZX gage and a fairly well defined rating curve. No flow Dec. 16 to Apr. 7 and Sept. 26.

Monthly discharge of Conn ditch near Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3.0	0.1	1.57	97
November	.7	.1	.24	14
December (15 days)	.5	.1	.27	8
April (23 days)	.3	.1	.20	9
May	13	.1	1.28	79
June	10.7	.2	5.47	326
July	11.1	6.0	8.83	543
August	9.3	.5	4.60	283
September (29 days)	6.3	.1	3.45	198
The year	....	....	....	1,560

NOTE.—See footnote to daily discharge table.

SMALLS CREEK AT PAISLEY, OREG.

Location.—In SW. ¼ sec. 24, T. 33 S., R. 18 E., in western part of Paisley, Lake County, just above road bridge, about 200 yards below point of diversion from Chewaucan River, and about same distance above head gate of Bagley ditch.

Records available.—January 18, 1914, to September 30, 1916.

Gage.—Vertical staff on right bank. An old gage was used up to June 28, 1914. Gage readers, Bert Harber, A. A. Farrow, and W. S. Daniels.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—A natural stream channel, narrow, with well-defined banks, fairly straight, with gravel bed; shifts only at high stages.

Extremes of discharge.—Maximum stage recorded during year, 2.0 feet May 23, 24, June 5 and 6 (discharge, 76 second-feet); minimum stage recorded, 0.4 foot February 29 and March 1 (discharge, 0.2 second-foot).

1914–1916: Maximum stage recorded, 2.2 feet May 15, 1914 (discharge, 107 second-feet); minimum stage recorded, 0.4 foot November 11, 1914, and February 29 and March 1, 1916 (discharge, 0.2 second-foot).

Ice.—Stage-discharge relation seriously affected by ice.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read once a day by Harber and Farrow to half-tenths; occasionally by Daniels to hundredths. Daily discharge ascertained by applying to rating table the mean daily gage height. Records good for irrigating season; poor for other times.

Cooperation.—Field data furnished by Chewacan Land & Cattle Co., W. C. Hammatt, consulting engineer, and by Northwest Townsite Co.

Smalls Creek is a natural slough or defluent of Chewaucan River and has been converted into an irrigation canal. It diverts water from the river in the SW. ¼ sec. 24, T. 33 S., R. 18 E., and irrigates 2,417 acres of the alluvial fan of Chewaucan River above the upper marsh, including 1,209 acres watered from Bagley ditch, which diverts water from Smalls Creek a short distance from the river. The irrigation season extends from about April 1 to September 15. Water is diverted at other times for watering stock. Surplus and return waters find their way to the marsh.

Discharge measurements of Smalls Creek at Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	W. S. Daniels[a]	0.67	1.8	Apr. 24	Bert Harber	1.30	25.2
Nov. 18	Bert Harber[b]	.85	4.2	May 22	W. S. Daniels	1.95	70
Dec. 23	.....do	.90	8.5	26	Bert Harber	1.90	67
Jan. 25	.....do	1.15	1.4	June 17	.....do	1.80	64
Feb. 7	E. R. Greenslet[a]	1.10	2.0	July 28	.....do	1.25	21.8
28	Bert Harber	.60	1.5	Aug. 16	.....do	1.15	15.1
Mar. 20	.....do	.90	7.5	Sept. 21	F. F. Henshaw	.93	8.2
28	W. S. Daniels	.80	4.4	21	Bert Harber	.93	8.7
Apr. 14	.....do	1.35	27.8				

[a] Employee of Northwest Townsite Co.

[b] Employee of Chewacan Land & Cattle Co.

Daily discharge, in second-feet, of Smalls Creek at Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	12	2.8	6.0	3.0	2.0	0.2	5.0	20	67	51	14	12
2	7.0	3.0	7.0	5.0	2.0	.5	4.0	20	63	47	12	10
3	7.0	3.0	8.5	5.0	2.0	.8	5.0	20	63	30	12	10
4	8.5	3.0	9.4	5.0	2.0	1.0	5.0	55	67	26	12	12
5	8.5	3.0	7.0	5.0	2.0	2.4	5.0	59	74	19	14	14
6	8.5	2.7	8.5	5.0	2.0	1.0	16	59	76	30	12	14
7	8.5	.6	7.0	5.0	2.0	1.0	18	51	55	45	12	14
8	8.5	2.0	6.8	5.0	2.0	3.0	20	48	59	43	12	13
9	8.5	1.5	6.0	5.0	2.0	4.0	23	43	63	36	13	12
10	10	1.0	5.0	5.0	2.0	9.4	24	36	63	37	12	12
11	10	1.5	5.0	6.0	2.0	20	29	30	55	32	10	10
12	10	1.5	5.0	8.0	2.0	18	23	26	51	32	16	7.0
13	6.0	.6	5.0	6.0	1.5	10	20	26	47	26	16	7.0
14	6.0	1.4	1.6	5.0	2.2	9.4	24	23	43	29	16	7.0
15	6.0	3.0	3.0	5.0	2.2	10	29	23	43	26	14	7.0
16	6.0	2.2	8.5	4.0	2.2	10	23	24	57	23	14	6.0
17	6.0	3.0	5.0	4.0	4.0	10	27	26	57	40	16	10
18	6.0	4.2	7.0	4.0	5.0	10	20	33	57	32	7.0	10
19	7.0	5.2	8.5	3.0	5.0	10	19	67	51	26	6.0	14
20	7.0	6.0	10	3.0	5.0	7.0	18	69	45	23	6.0	6.0
21	8.5	6.0	8.5	3.0	5.0	6.0	20	72	40	14	6.0	7.0
22	8.5	5.4	8.5	2.0	4.0	5.0	20	67	32	23	6.0	8.5
23	10	6.0	7.0	2.0	5.0	5.0	20	76	29	28	5.8	10
24	7.0	5.8	4.0	2.0	2.2	4.6	25	74	29	13	10	10
25	7.0	6.0	7.0	1.4	3.0	5.0	29	72	51	14	10	5.0
26	7.0	5.0	3.0	1.5	4.0	4.0	21	69	44	12	10	5.0
27	7.0	4.0	1.5	1.5	3.0	5.0	20	67	55	20	12	5.0
28	6.2	1.5	3.0	1.5	1.5	5.0	20	67	45	20	12	7.0
29	6.0	3.0	3.0	1.5	.2	4.0	19	69	36	19	12	6.0
30	4.6	5.0	3.0	1.5	......	4.0	18	63	47	18	12	6.0
31	3.0	......	3.0	1.5	......	4.0	......	67	......	14	12	......

Monthly discharge of Smalls Creek at Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	12.0	3.0	7.48	460
November	6.0	.6	3.30	196
December	10.0	1.5	5.85	360
January	8.0	1.4	3.72	229
February	5.0	.2	2.72	156
March	20.0	.2	5.95	366
April	29.0	4.0	19.0	1,130
May	76.0	20.0	49.1	3,020
June	76.0	29.0	52.1	3,100
July	51.0	12.0	27.2	1,670
August	16.0	5.8	11.4	701
September	14	5.0	9.22	549
The year	76.0	.2	16.5	10,900

BAGLEY DITCH AT PAISLEY, OREG.

Location.—In SW. ¼ sec. 24, T. 33 S., R. 18 E., just below head gate, in Paisley, Lake County.

Records available.—January 18, 1914, to September 30, 1916.

Gage.—Vertical staff on left bank. Gage readers, Bert Harber and Richard Guinee.

Discharge measurements.—Made by wading or from plank across ditch at gage.

Channel and control.—Earth channel; control unstable.

Extremes of discharge.—Maximum stage recorded during year, 1.95 feet May 23 to 25, 27, and June 5 and 6 (discharge, 40 second-feet). Canal dry at times.

1914–1916: Maximum stage recorded, 2.5 feet May 15, 1914 (discharge, 68 second-feet.)

Ice.—Stage-discharge relation affected by ice. Only a small amount of water is carried in extremely cold weather.

Accuracy.—Stage-discharge relation changed during ice period and again when ditch was cleaned out, April 26 to May 5. Three fairly well defined rating curves used October 1 to February 11, February 12 to April 25, and May 6 to September 30, respectively. Gage read daily to half-tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good for irrigating season; fair for rest of year.

Cooperation.—Field data furnished by Chewacan Land & Cattle Co., W. C. Hammatt, consulting engineer.

Bagley ditch (sometimes called Brattain ditch) diverts water from Smalls Creek in the SW. ¼ sec. 24, T. 33 S., R. 18 E., a few hundred yards below the point where Smalls Creek diverts from Chewaucan River; extends 6 miles in a southerly direction, and irrigates 1,209 acres lying above the area watered by Smalls Creek. Return and waste waters reach upper Chewaucan Marsh. The irrigation season extends from late in March or early in April to about September. Water is diverted for stock throughout the year.

Discharge measurements of Bagley ditch at Paisley, Oreg., during the year ending Sept. 30, 1916.

[Made by Bert Harber.[a]]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 24	1.10	5.8	Mar. 20	1.00	5.6	July 28	1.35	18.4
Nov. 18	.95	3.3	Apr. 24	1.55	13.4	Aug. 16	1.00	11.2
Dec. 23	1.15	4.8	May 7	1.60	29.6	Sept. 21	.81	6.6
Jan. 25	1.05	.7	May 26	1.90	37.5			
Feb. 28	.70	1.0	June 17	1.65	31.9			

[a] Employee of Chewacan Land & Cattle Co.

Daily discharge, in second-feet, of Bagley ditch at Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.2	1.0	6.0			3.8		38	30	12	10
2	5.2	1.0	6.0		2.4	3.8		37	28	11	9.0
3	3.5	1.4	7.0		5.3	3.8		38	24	12	9.0
4	3.5	1.0	8.0		.4	3.8		38	22	11	11
5	3.5	1.0	7.0		2.4	3.8		40	14	12	15
6	3.5	1.0	7.0		.5	12	11	40	7	12	12
7	3.5		7.0		3.8	13	28	35	26	12	12
8	3.5	.8	7.0		3.1	14	26	32	26	11	11
9	3.5	.6	6.0		1.7	15	26	32	26	12	11
10	4.3	.6	4.3		6.0	16	24	32	25	12	11
11	4.3	.6	5.2		9.0	19	22	32	25	11	11
12	5.2	.6	5.2	2.4	6.8	11	19	28	24	16	6.2
13	3.5	.1	6.0	1.7	6.8	11	19	26	22	15	6.2
14	3.5	.4	1.7	2.4	5.3	13	18	26	19	15	5.3
15	3.5	2.2	3.5	2.4	6.0	14	18	30	19	15	5.3
16	4.3	1.7	5.2	2.4	6.8	13	19	30	19	14	5.3
17	4.3	2.7	3.5	3.8	6.0	14	19	30	25	10	9.0
18	4.3	3.5	4.3	4.6	6.8	11	22	30	24	5.3	9.0
19	5.2	3.7	4.3	4.6	6.8	11	37	28	24	4.6	11
20	6.0	3.5	4.3	3.8	5.3	11	38	26	16	4.0	6.2
21	7.0	4.3	4.3	3.8	5.3	11	38	25	14	4.0	7.0
22	8.0	4.1	4.3	3.8	4.6	12	38	22	18	4.0	7.0
23	9.0	6.0	4.8	3.1	3.8	13	40	20	15	4.0	8.0
24	6.0	4.3	3.0	1.7	3.8	14	40	20	14	9.0	10
25	5.2	5.2	3.0	2.4	3.8	13	40	28	11	9.0	3.4
26	5.2	4.3	2.0	3.1	3.8		38	26	11	9.0	4.0
27	5.2	3.5	1.0	3.1	3.8		40	30	19	10	4.0
28	4.3	1.0	2.0	1.0	3.8		38	26	20	10	7.0
29	4.3	6.4	2.0		3.8		38	24	19	11	4.6
30	4.3	6.0	2.0		3.4		37	25	19	11	4.0
31	1.4		2.0		3.1		38		12	11	

Note.—Mean discharge estimated Jan. 1-21 and Feb. 7-11, 2 second-feet; Jan. 22-24 and Jan. 26 to Feb. 6, 1 second-foot; Dec. 18-31, as in table. Canal dry Nov. 7, Feb. 29, Mar. 1, and Apr. 26 to May 5.

Monthly discharge of Bagley ditch at Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9.0	1.4	4.62	284
November (29 days)	6.4	.1	2.50	144
December	8.0	1.0	4.48	276
January	....	....	1.67	103
February (28 days)	4.6	1.0	2.36	131
March (30 days)	9.0	.4	4.47	266
April (25 days)	19	3.8	11.2	555
May (26 days)	40	11	29.7	1,530
June	40	20	29.8	1,770
July	30	7.0	19.9	1,220
August	16	4.0	10.3	633
September	15	3.4	8.15	485
The year	....	....	....	7,400

NOTE.—See footnote to daily discharge table.

JONES-INNIS-ZX DITCH NEAR PAISLEY, OREG.

LOCATION.—In NW. ¼ sec. 19, T. 33 S., R. 19 E., about 100 yards below intake and a mile east of Paisley, Lake County.

RECORDS AVAILABLE.—July 20, 1914, to September 30, 1916.

GAGE.—Vertical staff; read by Bert Harber and A. A. Farrow.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel excavated in gravel; control fairly permanent. Stage-discharge relation affected at times by growth of aquatic plants.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.85 feet June 7 to 10 (discharge, 120 second-feet). Canal dry at stage of about 0.6 foot March 15, and July 5 to August 3.

ICE.—Stage-discharge relation badly affected by ice during winter; discharge at such times is very small.

ACCURACY.—Stage-discharge relation permanent except for period April to June, when there was backwater caused either by growth of aquatic plants or by operation of check gates. Rating curve well defined. Gage read once daily to half-tenths. Daily discharge ascertained by applying daily gage height to rating table, except April 28 to June 25, when indirect method for shifting control was used. Records good during irrigating season; poor rest of year.

COOPERATION.—Field data furnished by Chewacan Land & Cattle Co.

Jones-Innis-ZX ditch (so called from the largest water users under it, ZX being the common name of the Chewacan Land & Cattle Co.'s ranch) diverts water from Chewaucan River in the NW. ¼ sec. 19, T. 33 S., R. 19 E., into natural sloughs, from which is irrigated an area of 2,218 acres of the lowest part of the alluvial fan of Chewaucan River immediately above the upper marsh. One of these, Paisley Slough, at its lower end discharges into the "Stock ditch" which is used for irrigation and watering cattle. The irrigating season extends from early in April to about July 1. Water is diverted practically the entire year for either irrigation or stock.

Discharge measurements of Jones-Innis-Z X ditch near Paisley, Oreg., during the year ending Sept. 30, 1916.

Date.		Made by—	Gage height.	Discharge.	Date.		Made by—	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Oct.	24	Bert Harber	1.45	11.5	May	8	Daniels and Finch	2.70	96
Nov.	19	.....do	1.10	3.0		16	W. S. Daniels	2.33	75
Mar.	21	.....do	.95	3.4		30	Bert Harber	2.60	96
	21	.....do	.95	1.3	June	7	Daniels and Finch	2.81	114
Apr.	13	W. S. Daniels	.85	.5		18	Bert Harber	2.65	98
	26	.....do	2.53	97		20	W. S. Daniels	2.49	89
	26	Bert Harber	2.55	97	July	3	.....do	2.29	76

Daily discharge, in second-feet, of Jones-Innis-ZX ditch near Paisley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.0	3.0	3.0	......	1.7	0.8	86	92	76	......	1.7
2	2.4	4.0	3.0	......	1.2	.8	99	103	76	......	1.2
3	4.0	4.0	3.0	......	1.7	.8	103	103	70	......	1.2
4	4.9	4.0	3.0	......	1.2	.8	103	103	65	1.7	1.7
5	4.9	4.0	3.0	......	1.2	.8	81	112	......	1.7	1.7
6	4.9	4.0	3.0	......	.8	.8	76	114	......	1.7	1.7
7	4.9	3.0	3.0	......	1.2	.8	81	114	......	1.7	1.5
8	4.9	3.0	3.0	......	.8	.9	96	120	......	1.7	1.4
9	4.0	3.0	3.0	......	1.2	.8	92	120	......	1.7	1.3
10	4.0	.2	2.4	......	2.4	.8	76	120	......	1.7	1.2
11	4.9	4.0	4.0	......	1.2	.6	64	114	......	1.2	1.7
12	4.9	3.0	3.0	......	.3	.6	60	108	......	.8	1.7
13	7.2	3.0	3.0	......	.3	.6	60	103	......	1.7	1.2
14	7.2	3.0	2.4	......	.3	.6	60	103	......	1.2	1.2
15	7.2	3.0	2.4	......	......	.6	65	98	......	1.2	4.0
16	6.0	3.0	3.0	......	1.7	17	72	98	......	1.2	7.2
17	6.0	3.0	3.0	......	.3	22	70	92	......	1.7	7.2
18	7.2	3.0	3.0	......	1.7	18	88	98	......	1.7	6.0
19	7.2	3.0	3.0	......	1.7	16	82	95	......	1.2	6.0
20	6.0	3.0	3.0	0.8	1.4	15	76	89	......	1.2	4.9
21	6.0	3.0	4.0	.8	1.2	71	56	86	......	1.2	4.9
22	6.0	3.0	3.0	.8	.8	81	98	81	......	1.7	4.9
23	7.2	3.0	4.0	1.7	1.2	86	103	76	......	1.7	8.6
24	12	3.0	4.0	1.7	1.7	96	100	70	......	1.7	7.2
25	8.6	3.0	3.0	1.7	.6	70	98	70	......	1.7	8.6
26	7.2	1.7	4.0	1.7	.3	88	92	56	......	1.7	8.6
27	4.0	1.2	3.0	1.7	.3	114	98	60	......	1.7	10
28	4.0	.3	3.0	1.2	.3	103	93	56	......	1.7	10
29	3.0	3.0	3.0	1.2	.6	84	86	65	......	1.7	10
30	3.0	3.0	3.0	......	.4	92	96	70	......	1.7	8.6
31	3.0	......	3.0	......	.3	......	94	......	......	1.7	......

NOTE.—Stage-discharge relation affected by ice Dec. 28 to Feb. 19; mean discharge estimated as 3 second-feet Dec. 28–31 and 1 second-foot Jan. 1 to Feb. 19. No flow March 15 and July 5 to Aug. 3. Daily discharge interpolated Sept. 7–9.

Monthly discharge of Jones-Innis-ZX ditch near Paisley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	12	2.4	5.47	336
November	4.0	.2	2.91	173
December	4.0	2.4	3.10	191
January	....	....	1.0	62
February	1.7	....	1.11	64
March (30 days)	2.4	.3	1.00	60
April	114	.6	32.8	1,950
May	103	58	84.0	5,160
June	120	56	93.0	5,530
July (4 days)	76	65	71.8	570
August (28 days)	1.7	.8	1.54	86
September	10	1.2	4.57	272
The year	....	....	....	14,500

SILVER LAKE BASIN.

SILVER CREEK NEAR SILVER LAKE, OREG.

Location.—In SW. ¼ sec. 28, T. 28 S., R. 14 E., at dam site of proposed Egli reservoir, 1½ miles southwest of Silver Lake post office, Lake County, and about 3 miles above mouth of Bridge Creek.

Drainage area.—221 square miles.

Records available.—December 29, 1904, to March 31, 1907, January 11, 1909, to September 30, 1916.

Gage.—Inclined staff on right bank, read since July 24, 1915; vertical staff on right bank, 10 feet upstream, used April 5, 1912, to July 23, 1915; inclined staff at location of present gage, 1905 to 1912. Gage reader, J. H. Gowdy.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Composed of rocks and gravel; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year, 5.7 feet at 9.30 a. m. March 20 (discharge, 710 second-feet); minimum stage recorded during year, 0.15 foot October 9 (discharge, 0.8 second-foot).

1905–1907 and 1909—1916: Maximum stage recorded, 6.40 feet at 4 p. m. November 23, 1909 (discharge, 910 second-feet); minimum stage recorded, 0.15 foot August 7–8 and October 9, 1915 (discharge, 0.8 second-foot).

Ice.—Stage-discharge relation somewhat affected by ice.

Diversions.—A few small tracts irrigated above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation changed during high water, the change affecting only medium and low stages. Fairly well defined rating curves used; identical above gage height 2.5 feet. Gage read to quarter-tenths daily February 10 to June 30 and about three times a week at other times. Daily discharge ascertained by applying daily gage height to rating table. Records only fair on account of diurnal fluctuation during spring flood and uncertainty of rating at other times.

Discharge measurements of Silver Creek near Silver Lake, Oreg., during the year ending Sept. 30, 1916.

[Made by Henshaw and Batchelder.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 3	0.28	1.8
3	.28	1.5
June 11	1.07	31.0

Daily discharge, in second-feet, of Silver Creek near Silver Lake, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	1.5			19	217	138	47	30		
2	1.5	1.5	8.0		19	192	148	47		14	11
3	1.8	1.5			17	192	158	44	27		11
4		1.5	19		15	192	158	44	27	13	
5	1.0	1.5			13	217	148	44		13	11
6		1.5	5.0		15	290	138	41	25		
7	1.0	1.5	19		19	204	138	41	23	12	
8	1.0	1.5			21	245	120	41	21		10
9	.8	1.4	8		45	360	102	38		11	
10	1.5	1.2			100	420	98	32	21		10
11		1.1	5.0		169	400	86	32		11	
12		1.0			148	231	78	30	20	13	10
13		.8	4.6		180	217	68	28	19		
14	1.8	1.1			158	260	64	30	22	13	10
15		1.3		11	138	245	57	30	21		
16	2.0	1.5		13	148	231	57	30	21	13	10
17	2.0	1.5		15	158	275	57	30	21	9.5	10
18		1.5		15	217	260	57	31			
19		2.0		17	520	231	57	30	19	9.5	
20	2.0	2.0		21	710	148	57	30			
21		2.0	5.0	21	560	120	57	30	19	9.5	
22		2.0		23	380	180	47	31	17		9.5
23	1.5	4.0	6.5	25	306	180	50	31		9.5	
24	1.5	5.0		25	217	148	64	30	15		9.5
25		5.0	5.0	27	169	192	57	30			
26		4.6	5.0	33	138	192	60	32	15	8.0	
27	1.5	3.0		30	217	158	94	27		8.0	
28		2.0		25	169	148	138	27	15		9.5
29		3.5		21	169	148	68	27	14	9.5	
30	1.5	5.0			169	138	57	27			
31	1.5				158		57		14		

NOTE.—Stage-discharge relation affected by ice Nov. 12, 13, Dec. 15–20, and Dec. 28 to Feb. 14; mean discharge estimated from observer's notes and temperature records as follows: Dec. 15, 18, and 19, 4 second-feet; and Dec. 28 to Feb. 5, 3 second-feet; Feb. 6–14, 6 second-feet. Daily discharge interpolated Nov. 1-3, 5, 7, 9, 10, 15, 27, and 29.

Monthly discharge of Silver Creek near Silver Lake, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October		0.8	[a] 1.49	92
November	5.0	.8	2.15	128
December			[a] 7.01	431
January			[b] 3.0	184
February	33		13.5	776
March	710	13	177	10,900
April	420	120	221	13,200
May	158	47	88.2	5,420
June	47	27	33.7	2,010
July	30	14	[a] 20.3	1,250
August			[a] 11.0	676
September			[a] 10.1	601
The year	710	.8	49.0	35,700

[a] Computed as the mean of actual number of days on which discharge is given for the month.
[b] Estimated.

MALHEUR AND HARNEY LAKES BASIN.

MALHEUR LAKE OUTLET AT NARROWS, OREG.

Location.—In sec. 26, T. 26 S., R. 31 E., at highway bridge across channel connecting Malheur and Harney lakes, a few hundred feet west of Narrows, Harney County.

Records available.—March 14, 1903, to July 21, 1906; March 22, 1911, to June 29, 1912; occasional readings in 1913, 1914, and 1916. Discontinued.

Gage.—Vertical staff on highway bridge; datum at elevation 4,088.00 feet in 1903; 4,089.06 in 1912, 4,089.02 in 1913, and 4,088.86 feet in 1916, based on the latest elevation of 4,096.20 feet above sea level for iron post bench mark at east end of bridge.

Discharge measurements.—Made from highway bridge; current very sluggish; conditions poor.

Channel and control.—Channel of mud overgrown with aquatic plants; no defined control; backwater may be caused by filling up of Mud Lake below.

Extremes of stage.—1903–1916: Maximum stage recorded, 7.3 feet May 12 to 16, 1904 (discharge uncertain). Channel dry (bottom at elevation about 0.34 foot) September 16, 1911, to about April 15, 1912.

Ice.—No ice during period of records.

Diversions.—Flow past this point is only a small residue left from irrigation of thousands of acres and evaporation from surface of Malheur Lake.

Accuracy.—Stage-discharge relation unstable, affected by growth of aquatic plants and backwater. Gage read only occasionally. Only a rough estimate of total run-off past this point can be made. (See footnote to table of discharge measurements.)

Discharge measurements of Malheur Lake outlet at Narrows, Oreg., during the year ending Sept. 30, 1916.

[Made by P. V. Hodges.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 25	4.21	66	May 22	5.20	142
May 1	4.68	183	June 7	5.40	187
14	5.00	203			

Gage readings and discharge of Malheur Lake outlet at Narrows, Oreg., in 1916.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 31	2.57	0	May 26	5.25	155
Apr. 6	2.57	0	June 13	5.35	175
May 6	4.90	200			

Note.—Total run-off estimated as follows: April, 1,550 acre-feet; May, 10,900 acre-feet; June, 8,690 acre-feet; July, 3,700 acre-feet; the period, 24,800 acre-feet.

MUD LAKE OUTLET NEAR NARROWS, OREG.

Location.—In NW. ¼ sec. 17, T. 27 S., R. 30 E., about half a mile above gap in sand reef through which outlet enters Harney Lake, 4 miles southwest of Mud Lake, and 6 miles southwest of Narrows, Harney County.

Records available.—May 10 to July 19, 1916.

Gage.—Vertical staff on bent of bridge. Gage reader, John Rusek.

Discharge measurements.—Made from footbridge; channel deep and narrow; current swift.

Channel and control.—Channel of mud and sand, scouring rapidly; no defined control.

Extremes of discharge.—Maximum stage recorded during season, 2.00 feet May 25 (discharge, 112 second-feet); may have gone slightly higher. Stream bed dry up to May 9.

Ice.—No flow during ice period.

Diversions.—A little hay land is irrigated by natural overflow below the gage on Malheur Lake outlet; most of the loss is caused by evaporation on Mud Lake.

Accuracy.—Stage-discharge relation unstable owing to erosion of the friable stream bed by the swift current. Fairly well defined rating curve used May 10 to 25; indirect method for shifting control, May 28 to 31; poorly defined rating curve, June 4 to July 19. Gage read to hundredths about twice a week, but fluctuation in stage very gradual. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Mud Lake outlet near Narrows, Oreg., during the year ending Sept. 30, 1916.

[Made by P. V. Hodges.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec-ft.*		*Feet.*	*Sec-ft.*
May 14	1.05	41.7	June 8	1.72	103
22	1.82	96	13	1.60	96

Daily discharge, in second-feet, of Mud Lake outlet near Narrows, Oreg., for the year ending Sept. 30, 1916.

Day.	May.	June	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1				11		102		21	96	61	
2			45	12			24	22	98		
3				13		95		23			
4		109		14	42	95		24	96		
5			40	15				25	112	55	
6				16			24	26			
7		109		17				27			
8		103		18		81		28	100	50	
9			32	19			18	29			
10	12			20				30			
								31	105		

Note.—Mean discharge estimated 12 second-feet July 20-31.

Monthly discharge of Mud Lake outlet near Narrows, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 10-31	112	12	74.8	3,260
June	109	50	82.8	4,930
July	45		23.7	1,460
The period				9,650

Note—Means in table computed from actual number of days for which discharge is given.

SILVIES RIVER NEAR SILVIES, OREG.

Location.—In NE. ¼ sec. 14, T. 20 S., R. 31 E., at site of proposed storage dam, three-quarters of a mile below Trout Creek, about a mile southwest of Craddock's ranch, and 3 miles southwest of former post office of Silvies, Harney County.

Drainage area.—510 square miles (measured on map prepared by United States Reclamation Service).

Records available.—May 9, 1903, to December 31, 1904; January 1, 1909, to June 30, 1911; April 11 to June 9, 1912; April 1 to June 13, 1916.

Gage.—Inclined staff at dam site was read April 2 and 3, and occasionally for comparisons thereafter. A temporary vertical staff just back of Craddock's house was read daily after April 4. Gage reader, David Craddock.

Discharge measurements.—Both measurements in 1916 made at Winnemier's bridge about one-half mile above the upper gage, and the inflow below the bridge and above the lower gage added. Conditions not particularly good, but the measurements checked the old rating curve fairly well. Earlier measurements made from cable 50 feet above gage or by wading.

Channel and control.—Stream tortuous and flat below both gages. No defined control. At high stages water overflows to the right of the lower gage, and spreads out for a width of nearly half a mile at the upper gage.

Extremes of discharge.—Maximum stage recorded during year, 10.66 feet during night of April 2, from high-water marks the next morning (discharge, 1,590 second-feet). No record of minimum.

1903–4, 1909–11, 1912, and 1916: Maximum stage recorded, 12.15 feet April 16, 1904 (discharge, 2,320 second-feet). Stream bed dry August 22 to September 12, 1910.

Ice.—No record during winter.

Diversions.—Several hundred acres irrigated from flood waters above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation at both gages fairly permanent; rating curve poorly defined. Gage read once a day to nearest tenth. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Silvies River near Silvies, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.
		Regular gage.	Temporary gage.	
		Feet.	*Feet.*	*Sec.-ft.*
Apr. 3	F. F. Henshaw	10.08	....	1,190
May 11	P. V. Hodges	6.58	7.65	446

Daily discharge, in second-feet, of Silvies River near Silvies, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	1,100	730	300	11	1,480	430	160	21	870	412	......
2	1,400	562	300	12	1,180	412	160	22	870	330	......
3	1,340	532	270	13	1,060	381	160	23	870	330	......
4	1,060	508	241	14	1,060	349	......	24	800	330	......
5	1,060	488	213	15	1,320	318	......	25	800	315	......
6	960	468	186	16	1,060	286	......	26	870	378	......
7	800	448	186	17	960	255	......	27	870	408	......
8	870	444	173	18	960	255	......	28	730	346	......
9	960	438	173	19	870	330	......	29	730	300	......
10	1,320	434	160	20	870	430	......	30	730	285	......
								31	....	300	......

Note.—Daily discharge interpolated May 8–10 and 13–16; estimated Apr. 1.

Monthly discharge of Silvies River near Silvies, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	1,480	730	994	59,100
May	730	255	397	24,400
June 1-13	300	160	206	5,320
The period				88,800

SILVIES RIVER NEAR BURNS, OREG.

Location.—In SW. ¼ sec. 31, T. 21 S., R. 30 E., about a mile above Sylvester's ranch, and 12 miles northwest of Burns, Lake County.

Drainage area.—940 square miles (measured on United States Reclamation Service map).

Records available.—May 10, 1903, to July 24, 1906; December 14, 1908, to September 30, 1915; February 1 to June 19, 1916.

Gage.—Gurley printing water-stage recorder on left bank, installed December, 1911. Prior to that time station was about 1¼ miles downstream, at wagon bridge near Parker's house, in sec. 7, T. 22 S., R. 30 E.

Discharge measurements.—Made from cable about one-fourth mile below gage, or by wading.

Channel and control.—Low-water control is a gravel riffle about 25 feet below gage. Probably shifts in high water. Above gage height 13 feet river overflows its banks near the gage and begins cutting across the bends, with no defined control.

Extremes of discharge.—Maximum stage from water-stage recorder, 16.84 feet April 12 (discharge, 2,610 second-feet). No record of minimum.

1904–1906 and 1909–1916; Maximum stage recorded, 17.12 feet April 15, 1904 (discharge, 4,730 second-feet); minimum stage recorded, 2.2 feet September 9 to 12, 1903 (discharge, 3 second-feet).

Ice.—Stage-discharge relation not seriously affected by ice.

Diversions.—A large area of land in the headwaters of Silvies River is irrigated with flood water.

Regulation.—None.

Accuracy.—Stage-discharge relation changed slightly during flood of 1916 by accumulation of débris under a log bridge one-half mile below gage. Rating curve well defined. Operation of water-stage recorder satisfactory after March 25. Stage-discharge relation affected by raising of Sylvester dam June 14 to about end of July. No discharge computed after June 19. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the printed record. Records good except for February.

Discharge measurements of Silvies River near Burns, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	Henshaw and Hodges	[a] 16.20	2,170	May 15	P. V. Hodges	8.40	461
16	P. V. Hodges	15.28	1,680	June 2	.....do	8.30	492
27	.....do	13.35	1,130	14	.....do	[b] 9.44	223

[a] Measured at bridges on Burns-Canyon City road; gage reading taken as mean for previous day at the station.

[b] Gage read 5.77 feet June 13, before closing irrigating dam, which caused backwater.

Daily discharge, in second-feet, of Silvies River near Burns, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1	....	1,180	1,060	450	16	600	1,700	450	209
2	....	1,520	975	470	17	800	1,650	410	201
3	....	1,950	899	450	18	1,000	1,600	390	193
4	....	1,950	832	410	19	1,200	1,480	440	198
5	....	1,900	808	370	20	1,500	1,420	520	....
6	....	1,800	796	330	21	1,750	1,300	540	....
7	....	1,650	796	300	22	1,600	1,230	530	....
8	....	1,560	796	280	23	1,470	1,160	450	....
9	....	1,600	784	271	24	1,330	1,120	430	....
10	300	1,750	727	244	25	1,200	1,100	450	....
11	500	2,180	661	222	26	1,200	1,100	490	....
12	450	2,510	628	222	27	1,230	1,120	540	....
13	410	2,180	584	226	28	1,280	1,140	584	....
14	440	1,900	530	217	29	1,280	1,140	510	....
15	500	1,750	490	217	30	1,140	1,120	430	....
					31	1,040	....	410	....

NOTE.—Daily discharge estimated Mar. 10-12, 15-20; interpolated Mar. 23-24; estimated June 14-19 by correcting recorded gage heights by amount of backwater shown by measurement June 14.

Monthly discharge of Silvies River near Burns, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February	....	....	*a* 81.0	4,660
March	1,750	....	746	45,900
April	2,510	1,100	1,560	92,800
May	1,060	390	611	37,600
June 1-19	470	193	288	10,900
The period	....	....	....	192,000

a Estimated.

WEST FORK OF SILVIES RIVER NEAR LAWEN, OREG.

LOCATION.—In SW. ¼ sec. 24, T. 25 S., R. 32 E., at Crowley Bridge, about a quarter of a mile from Herman Ruh's house and 5 miles southeast of Lawen, Harney County.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—March 31 to July 1, 1916.

GAGE.—Vertical staff on abutment of bridge. Gage reader, Frank A. Ruh.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge. The direction of the current makes an angle with the bridge, but this has been carefully measured and allowed for. At high stages some water flows through culverts on either side of the main bridge.

CHANNEL AND CONTROL.—Channel deep at bridge and bends to left just above it. Old Crowley dam acts as control; fairly permanent and no change made to it during time that records were being secured. The water surface below the dam is only slightly above that in Malheur Lake, and as the lake rose the drop at the dam became lessened until in June it was scarcely perceptible. Apparently no backwater effect on the gage until the end of June, if at all.

EXTREMES OF DISCHARGE.—Maximum stage recorded during season, 9.7 feet April 16 to 18 (discharge, 1,250 second-feet). Flow practically ceases during summer.

ICE.—No record during period when stream is frozen.

DIVERSIONS.—Many thousand acres of hay land irrigated from flood water above this point. East Fork diverts water about a mile southeast of Burns, the main channel below the bifurcation being known as West Fork.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent during season. Rating curve well defined. Gage read once a day to tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of West Fork of Silvies River near Lawen, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 31	F. F. Henshaw	8.89	644	Apr. 25	P. V. Hodges	9.38	922
Apr. 7	....do	9.20	934	May 13	....do	8.55	461
20	P. V. Hodges	9.60	1,160	June 7	....do	8.00	182

Daily discharge, in second-feet of West Fork of Silvies River near Lawen, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	676	730	225	11	940	540	144	21	1,170	370	86
2	708	730	225	12	940	480	144	22	1,090	370	86
3	740	660	225	13	1,010	420	144	23	1,090	320	86
4	772	660	182	14	1,090	420	144	24	1,010	270	86
5	804	660	182	15	1,170	420	112	25	1,010	270	86
6	837	660	182	16	1,250	420	112	26	940	270	86
7	870	660	144	17	1,250	420	112	27	870	270	86
8	940	600	144	18	1,250	420	112	28	870	270	86
9	940	600	144	19	1,170	420	86	29	800	225	86
10	940	540	144	20	1,170	420	86	30	730	225	86
								31	......	225	......

Note.—Daily discharge interpolated Apr. 1-6; estimated June 30.

Monthly discharge of West Fork of Silvies River near Lawen, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	1,250	676	968	57,600
May	730	225	450	27,700
June	225	86	128	7,620
The period	....	....	....	92,900

EAST FORK OF SILVIES RIVER NEAR LAWEN, OREG.

Location.—In sec. 5, T. 25 S., R. 33 E., half a mile south of Lawen, Harney County, at main road crossing.

Records available.—March 31 to June 15, 1916. Discontinued.

Gage.—Vertical staff on the upstream end of right abutment of the main culvert; readings made by Frank A. Ruh.

Discharge measurements.—Made from bridges; conditions fair except for extremely low velocities.

Channel and control.—Main channel narrow and tortuous and of inadequate capacity to carry discharge, which overflows surrounding fields and crosses road through a number of culverts. No control.

Extremes of discharge.—Maximum discharge during season, 272 second-feet at time of measurement April 21 (gage height, 2.30 feet); stage rose as discharge decreased. Practically no flow during fall and winter.

Ice.—No record.

Diversions.—Several thousand acres of land is watered from East Fork above the station, and some below it.

Regulation.—None.

Accuracy.—Stage-discharge relation affected by backwater from Malheur Lake and is no index of discharge. Daily discharge ascertained by taking percentages of discharge of West Fork. Coefficients were determined by interpolation between the percentages found on dates of measurements. Records poor.

Discharge measurements of East Fork of Silvies River near Lawen, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec-ft.*
Mar. 31	F. F. Henshaw	2.23	70	Apr. 25	P. V. Hodges	2.35	164
Apr. 7	....do	2.24	108	May 12	....do	2.45	58
21	P. V. Hodges	2.30	272	June 7	....do	2.58	36

Daily discharge, in second-feet, of East Fork of Silvies River near Lawen, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	74	110	36	11	122	70	29	21	272	48	......
2	78	110	36	12	132	62	29	22	229	48	......
3	81	92	38	13	142	58	29	23	218	42	......
4	85	92	31	14	164	55	29	24	192	38	......
5	88	92	33	15	187	55	22	25	182	38	......
6	100	92	35	16	200	55	......	26	160	38	......
7	108	86	36	17	212	55	......	27	148	38	......
8	113	78	29	18	225	55	......	28	139	40	......
9	113	78	29	19	222	55	......	29	128	34	......
10	122	70	29	20	246	55	......	30	110	34	......
								31	......	36	......

Monthly discharge of East Fork of Silvies River near Lawen, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April	272	74	153	9,100
May	110	34	61.6	3,790
June 1-15	38	22	31.3	931
The period	....	....	....	13,800

DONNER UND BLITZEN RIVER NEAR DIAMOND, OREG.

Location.—In SW. ¼ sec. 8, T. 32 S., R. 32½ E., at mouth of canyon, 1½ miles above "P" ranch buildings, about 25 miles southwest of Diamond, Harney County, and 40 miles above Narrows, Harney County.

Drainage area.—200 square miles (measured on special maps prepared by Garfield Stubblefield).

Records available.—May 22, 1910, to September 30, 1916; also January 26, 1909, to July 31, 1910, and November 1 to 12, 1910, at station below several diversion ditches.

Gage.—Vertical staff on left bank; zero of gage was raised 0.63 foot between 1913 and 1916, probably gradually. Gage reader, Jesus Achurra. Original gage was a vertical staff on right bank just below the wagon bridge near the ranch buildings.

Discharge measurements.—Made from cable 75 yards above gage or by wading.

Channel and control.—Bed composed of gravel and sand; one channel at all stages. Banks of stream covered with dense growth of willows and underbrush; subject to overflow at flood stages. Control of gravel; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 6.0 feet at 7 a. m. March 12 (discharge, 1,820 second-feet); minimum stage recorded, 1.5 feet December 19, 26, January 2, 9, and 16 (discharge, 23 second-feet).

1909–1916: Maximum stage recorded, 6.4 feet at 7.30 p. m. May 3, 1915 (discharge, 2,060 second-feet); minimum stage recorded in 1916.

Ice.—Stage-discharge relation not affected by ice.

Diversions.—Present gage is above all irrigation ditches. Five ditches divert water from the stream above the old gage at ranch buildings.

Regulation.—None.

Accuracy.—Stage-discharge relation changed during high water of March; rating curve used up to March 12 fairly well defined below 1,000 second-feet by measurements made in 1915; curve used thereafter well defined between 35 and 1,000 second-feet. Gage read once a week to half-tenths until February 6; daily thereafter. Daily discharge ascertained by applying daily gage height to rating table. Records good except for February and March, for which they are fair.

Discharge measurements of Donner und Blitzen River near Diamond, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	A. H. Page[a]	1.58	32.1	May 24	P. V. Hodges	2.15	168
Apr. 10	Hodges and Henshaw	2.29	202	June 9	.....do	3.00	433

[a] Employee of Blitzen Valley Land Co.

Daily discharge, in second-feet, of Donner und Blitzen River near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1					81	65	260	218	308	204	76	67
2				23	107	50	246	232	308	232	76	58
3	33				133	42	232	232	308	218	76	58
4					159	42	178	246	325	191	76	58
5			29		185	42	165	260	342	178	76	58
6					210	42	165	260	360	165	76	58
7		29			65	50	165	246	378	165	76	58
8					50	75	165	232	378	165	76	58
9				23	29	85	204	218	435	152	76	58
10	29				35	95	275	218	395	152	76	58
11					35	288	232	204	378	152	76	58
12			29		35	1,820	218	204	395	140	76	58
13					35	1,460	204	191	395	128	76	58
14		29			35	1,010	178	191	395	128	76	58
15					35	690	178	178	415	106	76	58
16				23	35	515	178	178	435	117	76	58
17	29				35	395	178	178	435	117	76	58
18					35	395	178	178	415	106	76	58
19			23		35	435	152	260	395	96	76	58
20					35	395	128	246	360	96	76	58
21		29			45	395	106	204	232	96	76	58
22					55	360	140	178	204	86	76	58
23				29	65	360	140	178	191	86	76	58
24	29				75	342	152	165	178	86	76	58
25					85	325	152	191	165	86	76	58
26			23		85	325	152	870	152	86	76	58
27					75	325	165	690	152	86	76	58
28		29			65	325	165	600	140	86	76	58
29					65	308	178	535	128	76	76	58
30				29		308	178	455	128	76	76	58
31	29					232		325		76	76	

Note.—Daily discharge interpolated Feb. 1-5, 21-24, and Sept. 17-23.

Monthly discharge of Donner und Blitzen River near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	33	29	29.8	1,830
November	29	29	29.0	1,730
December	29	23	26.0	1,600
January	29	23	25.4	1,560
February	210	29	69.6	4,000
March	1,820	42	374	23,000
April	275	106	180	10,700
May	870	165	283	17,400
June	435	128	308	18,300
July	232	76	127	7,810
August	76	76	76.0	4,670
September	67	58	58.3	3,470
The year	1,820	23	132	96,100

DONNER UND BLITZEN RIVER NEAR NARROWS, OREG.

Location.—In NE. ¼ sec. 26, T. 29 S., R. 31 E., at "grain camp" at bridge over movable diversion dam immediately below intake of Buena Vista canal, 2 or 3 miles above mouth of Keiger Creek, and about 25 miles south of Narrows, Harney County.

Drainage area.—Not measured.

Records available.—March 21 to July 31, 1915; April 7 to July 17, 1916.

Gage.—Vertical staff on west abutment of bridge. Gage reader, J. A. Miller.

Discharge measurements.—Made from cable about 70 feet below gage.

Channel and control.—Artificial channel excavated in clayey material; banks fairly even and not subject to overflow. No definite control.

Extremes of discharge.—Maximum stage recorded during year, 4.5 feet June 14 (discharge, 270 second-feet); minimum stage recorded, 1.25 feet May 4 (discharge, 16 second-feet).

Ice.—No records.

Diversions.—Buena Vista Canal and East Side ditch divert water from river just above gage; about 14,000 acres of the "P" ranch lands are irrigated by spring flooding from the river and its tributaries. (See p. 315 for records on Buena Vista Canal, and p. 326 for measurements of East Side ditch. Mean discharge for latter estimated as 6 seond-feet for 29 days in May; 6.7 second-feet for 7 days in June; and 5 second-feet for 5 days in July; total, 488 acre-feet.)

Regulation.—The diversion dam above the gage backs up the water 4 or 5 miles; the pondage thus created may affect materially the discharge of a day or two.

Accuracy.—Stage-discharge relation somewhat variable, especially at medium stages between 3 and 5 feet gage height; rating curve well defined. Gage read once daily to half-tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Donner und Blitzen River near Narrows, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	Hodges and Henshaw	3.28	126	May 23	P. V. Hodges	3.80	180
May 2	P. V. Hodges	2.22	50	June 10	do	3.60	158
2	do	2.90	92				

Daily discharge, in second-feet, of Donner und Blitzen River near Narrows, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		55	243	181	16	158	58	181	19
2		52	205	181	17	158	58	205	25
3		181	205	193	18	128	61	205	
4		16	193	193	19	119	128	205	
5		52	181	181	20	119	128	205	
6		52	169	181	21	119	193	205	
7	158	45	169	169	22	111	193	205	
8	156	103	158	169	23	119	181	181	
9	137	87	193	158	24	119	181	181	
10	137	80	147	50	25	119	181	181	
11	137	73	169	45	26	119	181	181	
12	147	67	158	22	27	119	181	169	
13	137	61	137	25	28	137	206	158	
14	137	61	270	22	29	128	230	158	
15	156	58	181	22	30	128	256	158	
					31		243		

Monthly discharge of Donner und Blitzen River near Narrows, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 7-30	158	111	134	6,380
May	256	16	119	7,320
June	270	137	185	11,000
July 1-17	193	19	108	3,640
The period				28,300

DONNER UND BLITZEN RIVER NEAR VOLTAGE, OREG.

Location.—In sec. 35, T. 26 S., R. 31 E., at bridge on road known as "Sod-house Lane," 2 miles west of Voltage post office, and 6 miles east of Narrows, Harney County.

Drainage area.—Not measured.

Records available.—April 6 to September 30, 1916.

Gage.—Vertical staff on downstream end of right abutment of bridge. Gage readers, R. J. Rimer and Harry Cole.

Discharge measurements.—Made from bridge across main channel and 16 culverts which carry water at high stages; measuring conditions poor.

Channel and Control.—Channel crooked and turns abruptly to right just below bridge; no defined control.

Extremes of discharge.—Maximum stage during year, 3.0 feet during March; observed from high-water marks (discharge estimated, 250 second-feet). Maximum discharge, 314 second-feet, including 120 second-feet flow through culverts (gage height, 2.47 feet) June 6. Minimum stage recorded, 0.85 foot September 28 (discharge, 43 second-feet).

Ice.—No record during ice period.

Diversions.—Several thousand acres irrigated from the river and its tributaries; discharge at station is largely return water.

Regulation.—Discharge considerbly influenced by diversion dams. Sudden rise of May 20 said to have been caused by breaking of dam.

Accuracy.—Stage-discharge relation for main channel variable and overflow is a function of gage height only in a general way. Gage read nearly every day to hundredths April 11 to July 20, and occasionally thereafter. Daily discharge ascertained by applying daily gage height to rating table. Records good for April and May; fair for other months.

Discharge measurements of Donner und Blitzen River near Voltage, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.		
			Main channel.	Over-flow.	Total.
		Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
Apr. 16	F. F. Henshaw	....	154	0	154
11	Hodges and Henshaw	1.68	121	0	121
21	P. V. Hodges	1.48	114	0	114
May 5	.....do	.80	67	22	89
22	.....do	2.25	131	76	207
June 7–8	.....do	2.40	160	121	281
12	.....do	2.35	155	77	232

Daily discharge, in second-feet, of Donner und Blitzen River near Voltage, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	96	302	200	......	......	16	141	95	233	66	50	......
2	......	92	297	216	......	......	17	144	93	230	61	......	......
3	......	97	302	216	......	......	18	124	95	229	90	......	......
4	......	94	286	216	......	......	19	116	100	246	90	55	......
5	......	89	297	216	60	......	20	111	300	246	104	......	......
6	154	89	314	216	......	......	21	112	163	246	......	......	50
7	148	91	297	180	......	......	22	110	186	246	......	50	......
8	141	90	288	180	......	......	23	108	199	248	......	......	52
9	135	91	231	150	......	......	24	108	203	247	......	50	......
10	128	93	223	136	50	......	25	111	193	230	......	......	......
11	122	94	255	122	......	......	26	111	250	232	......	......	......
12	128	94	232	113	50	......	27	111	225	238	......	......	......
13	136	93	232	88	......	......	28	110	250	211	......	45	43
14	132	95	258	80	......	......	29	105	235	212	......	......	......
15	137	96	234	74	......	......	30	100	225	206	122	......	45
							31	......	302	......	96	......	......

NOTE.—Daily discharge ascertained from fairly well-defined rating curves applicable Apr. 11–27, May 1 to June 7 and June 8 to Sept. 30. Discharge of overflow channels estimated separately and added to that given by rating table for main channel June 8 to July 9. Daily discharge interpolated Apr. 7–10 and 28–30. Mean discharge estimated as 100 second-feet July 21–29.

Monthly discharge of Donner und Blitzen River near Voltage, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 6–30	154	100	123	6,100
May	302	89	145	8,920
June	314	206	252	15,000
July	216	61	127	7,810
August	....	45	[a] 51.2	3,150
September	....	....	[a] 47.5	2,830
The period	....	....	....	43,800

[a] Computed as mean for actual number of days for which discharge is given.

MUD CREEK NEAR DIAMOND, OREG.

LOCATION.—In NW. ¼ sec. 4, T. 32 S., R. 32½ E., a quarter of a mile east of ranch field, about 2 miles east of "P" ranch buildings, and about 23 miles southwest of Diamond, Harney County.

DRAINAGE AREA.—30 square miles (measured on special maps prepared by Garfield Stubblefield).

RECORDS AVAILABLE.—March 18, 1911, to September 30, 1916, when station was discontinued.

GAGE.—Vertical staff driven into bed of creek on left bank. Gage reader, Jesus Achurra.

DISCHARGE MEASUREMENTS.—Made from footbridge near gage, or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. No defined control.

Extremes of discharge.—Maximum stage recorded during year, 4.5 feet May 26 (discharge, 100 second-feet); minimum discharge during year, 0.2 second-feet October 10, 17, and 24 (gage heght, 1.6 feet).

1911–1916: Maximum stage recorded, 5.65 feet at 6.30 p. m. May 3, 1915 (discharge, estimated from extension of rating curve, 154 second-feet); minimum stage recorded, 1.3 feet August 21 and 28, 1915 (discharge, 0.1 second-foot).

Ice.—Stage-discharge relation unaffected by ice.

Diversions.—None above station.

Regulation.—None.

Accuracy.—Stage-discharge relation unstable. Three fairly well-defined rating curves used, October 1 to March 12, March 13 to May 25, and May 26 to September 30, respectively. Gage read weekly until January 30, daily after February 6, to half-tenths. Daily discharge ascertained by applylng daily-gage height to rating table. Records fair.

Discharge measurements of Mud Creek near Diamond, Oreg., during the period Oct. 3, 1915 to Oct. 25, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
1915.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Oct. 3	A. H. Page	1.66	0.26	May 3	P. V. Hodges	[a] 2.55	17.5
1916.				June 9	do.	2.39	15.9
Apr. 10	Hodges and Henshaw	2.30	11.4	Oct. 25	Batchelder and Reineking	1.50	.34

[a] 2.58 feet after building rock control.

Daily discharge, in second-feet, of Mud Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1					2.5	1.3	8.0	13	18	8.0	0.9	0.3
2				0.2	3.6	1.3	8.0	15	18	8.0	.9	.3
3	0.3				4.7	1.3	8.0	19	18	8.0	.9	.3
4					5.8	1.3	7.0	19	18	6.0	.3	.3
5			0.2		6.9	1.3	7.0	19	18	5.2	.3	.3
6					8.0	1.3	7.0	20	18	4.5	.3	.3
7		0.2			3.0	2.0	9.0	20	18	4.5	.3	.3
8					.7	2.5	9.0	19	20	4.5	.3	.3
9				.2	.7	2.5	12	19	16	4.5	.3	.3
10	.2				.7	2.5	13	18	22	3.8	.3	.3
11					.7	3.0	12	17	21	3.0	.3	.3
12			.2		.7	30	12	16	21	3.0	.3	.3
13					1.3	32	12	15	20	3.0	.3	.3
14		.3			1.3	20	10	15	18	3.0	.3	.3
15					1.3	12	10	14	18	3.0	.3	.3
16				.2	1.3	12	10	14	18	3.0	.3	.3
17	.2				1.3	12	10	13	17	3.0	.3	.3
18					.7	12	10	13	16	3.0	.3	.3
19			.2		.7	12	10	18	15	2.2	.3	.3
20					1.3	12	8.0	17	15	2.2	.3	.3
21		.3			1.6	12	8.0	17	9.0	1.5	.3	.3
22					1.9	11	8.0	16	8.0	1.5	.3	.3
23				.3	2.3	10	8.0	16	6.0	1.5	.3	.3
24	.2				2.6	9.0	9.0	16	6.0	1.5	.3	.3
25					3.0	9.0	10	19	5.2	1.5	.3	.3
26			.2		3.0	8.0	11	100	4.5	1.5	.3	.3
27					2.0	8.0	11	75	4.5	1.5	.3	.3
28		.3			2.0	8.0	11	65	4.5	1.5	.3	.3
29					2.0	8.0	11	55	4.5	.9	.3	.3
30				.3		8.0	11	39	5.2	.9	.3	.3
31	.2					7.0		27		.9	.3	

Note.—Daily discharge interpolated Feb. 1–5, 21–24, and Sept. 17–23.

Monthly discharge of Mud Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	0.3	0.2	0.22	14
November	.3	.2	.28	17
December	.2	.2	.20	12
January	.3	.2	.24	15
February	8.0	.7	2.33	134
March	32	1.3	8.78	540
April	13	7.0	9.67	575
May	100	13.0	25.1	1,540
June	22	4.5	14.0	833
July	8.0	.9	3.23	199
August	.9	.3	.36	22
September	.3	.3	.30	18
The year	100	.2	5.40	3,920

NOTE.—Means October to January computed from weekly observations.

BRIDGE CREEK NEAR DIAMOND, OREG.

LOCATION.—In SE. ¼ sec. 34, T. 31 S., R. 32½ E., a quarter of a mile east of ranch field, about 4 miles northeast of "P" ranch buildings, and about 20 miles southwest of Diamond, Harney County.

DRAINAGE AREA.—35 square miles (measured on U. S. Reclamation Service map).

RECORDS AVAILABLE.—March 18 to August 31, 1911, and January 1, 1912, to September 30, 1916, when station was discontinued.

GAGE.—Vertical staff on left bank. Gage reader, Jesus Achurra.

DISCHARGE MEASUREMENTS.—Made from footbridge near gage.

CHANNEL AND CONTROL.—Bed composed of alluvium and clay; shifts slightly. One channel; banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet May 26 (discharge, 163 second-feet); minimum stage recorded, 1.55 feet October 3 to January 30 and February 9 to 20 (discharge, 7.5 second-feet).

1911–1916: Maximum stage recorded, 4.85 feet May 3, 1915 (discharge, 166 second-feet); minimum discharge, 7 second-feet (gage height, 1.85 feet) February 24 and 25, 1912.

ICE.—Stage-discharge relation unaffected by ice on account of large volume of flow from springs.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; rating curve fairly well defined; modified slightly below 25 second-feet to average measurements of 1915 and 1916. Gage read to half-tenths weekly until February 6; daily thereafter. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Bridge Creek near Diamond, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	Hodges and Henshaw	1.83	18.0	June 9	P. V. Hodges	1.90	20.0
May 3	P. V. Hodges	1.92	19.2	Oct. 15	Batchelder and Reineking	1.70	10.7
24	do	1.90	16.2				

Daily discharge, in second-feet, of Bridge Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1				7.5	20	9	12	18	29	16	12	12
2					26	9	12	18	27	16	12	12
3	7.5				32	9	12	18	25	15	12	12
4					38	9	10	18	25	15	12	12
5			7.5		44	9	10	18	23	15	12	12
6					50	9	10	20	23	15	12	12
7		7.5			37	9	10	21	23	15	12	12
8					10	10	10	20	23	15	12	12
9				7.5	7.5	10	16	18	18	15	12	12
10	7.5				7.5	18	18	18	21	14	12	12
11					7.5	25	16	16	21	14	12	12
12			7.5		7.5	48	16	16	21	14	12	12
13					7.5	45	16	16	18	14	12	12
14		7.5			7.5	29	15	16	16	14	12	12
15					7.5	23	15	16	15	14	12	12
16				7.5	7.5	23	15	16	15	14	12	12
17	7.5				7.5	21	15	16	15	14	12	12
18					7.5	15	15	16	15	14	12	12
19			7.5		7.5	21	15	31	15	14	12	12
20					7.5	20	14	25	15	14	12	12
21		7.5			8.0	18	14	18	15	14	12	12
22					8.5	16	15	16	15	14	12	12
23				7.5	9.0	16	15	16	15	14	12	12
24	7.5				9.5	15	16	16	15	14	12	12
25					10	15	16	31	15	14	12	12
26			7.5		10	14	16	163	15	14	12	12
27					9.0	14	16	95	15	14	12	12
28		7.5			9.0	12	16	65	15	14	12	12
29					9.0	12	16	58	15	12	12	12
30				7.5		12	16	45	15	12	12	12
31	7.5					12		31		12	12	

Note.—Daily discharge interpolated Feb. 1-5, 21-24, Mar. 6 and 10, and Sept. 17-23.

Monthly discharge of Bridge Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	7.5	7.5	7.50	461
November	7.5	7.5	7.50	446
December	7.5	7.5	7.50	461
January	7.5	7.5	7.50	461
February	50	7.5	14.8	851
March	48	9.0	17.0	1,050
April	18	10	14.3	851
May	163	16	29.8	1,830
June	29	15	18.4	1,090
July	16	12	14.2	873
August	12	12	12.0	738
September	12	12	12.0	714
The year	163	7.5	13.5	9,830

Note.—Means for October to January determined from weekly computations of discharge.

KEIGER CREEK NEAR DIAMOND, OREG.

Location.—In NW. ¼ sec. 10, T. 30 S., R. 33 E., about 100 yards above point where creek forks, about 2½ miles southeast of Diamond, Harney County.

Drainage area.—75 square miles.

Records available.—January 26, 1909, to May 31, 1910; May 14 to Aug. 31, 1911; February 14, 1912, to September 5, 1913; October 5 to 27, 1915; April 11 to September 2, 1916.

Gage.—Vertical staff on left bank; gage used 1909 and 1910 at different site and datum. Gage reader, Prim Ortega.

Discharge measurements.—Made from footbridge or by wading.

Channel and control.—Gravel; somewhat shifting. Banks brush-covered; not subject to overflow.

Extremes of discharge.—Maximum stage recorded during year, 3.4 feet, June 10 (discharge, 163 second-feet). Minimum discharge recorded, 4.3 second-feet (gage height, 1.25 feet, ice-affected), December 29.

1909–1910, 1912–1913, and 1915–1916: Maximum stage recorded, 4.7 feet, May 19, 1912 (discharge, 330 second-feet). A higher flood may have occurred while records were suspended. Minimum discharge, 4.3 second-feet, December 29, 1915.

Ice.—Stage-discharge relation somewhat affected by ice during extremely cold weather.

Diversions.—None above station.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent; rating curve fairly well defined. Gage read to half-tenths daily with occasional breaks. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Keiger Creek near Diamond, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	A. H. Page	1.08	6.6	May 5	P. V. Hodges	3.15	130
Dec. 29	do	[a]1.25	4.3	June 11	do	2.90	126
Apr. 11	Hodges and Henshaw	2.46	82				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Keiger Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1			66	86		16	8
2			56	70		16	8
3			86	70		16	
4			118	90		16	
5	6.6		145	110	52	16	
6	7		145	118	49	14	
7	7		118	110	78	14	
8	7		98	127	94	14	
9	7		90	127	110	14	
10			86	163	110	14	
11	7	82	102	127	56	12	
12	7	78	86	94	56	12	
13	8	63	52	94	49	14	
14	8	49	50	86	46	12	
15	8	49	49	94	43	12	
16	8	49	49	98	37	12	
17	8	49	63	98	49	12	
18	8	49	86	94	49	12	
19	8	49	110	89	37	12	
20	8	49	70	83	31	21	
21	8	55	63	78	31	21	
22	8	61	52	56	26	16	
23	8	66	49	49	26	16	
24	8	72	84	49	24	12	
25	8	78	118	52	21	12	
26	8	78	145	56	21	12	
27	8	90	102		21	10	
28		90	102		21	10	
29		74	102		21	9	
30		70	102		21	9	
31			98		21	9	

Note.—Mean discharge estimated at 50 second-feet June 27–30; 70 second-feet July 1–4. Daily discharge interpolated Apr. 21–24, 30, May 14, 18, 24, 28, June 4, 19, 20, and 25.

Monthly discharge of Keiger Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 11-30	90	49	65.0	2,580
May	145	49	89.4	5,500
June	163	....	85.6	5,090
July	110	21	47.7	2,930
August	21	9	13.5	830
The period	....	....	....	16,900

CUCAMONGA CREEK NEAR DIAMOND, OREG.

Location.—In NE. ¼ sec. 7, T. 30 S., R. 33 E., about a mile above old Cummings place, 2½ miles southwest of Diamond, Harney County.

Drainage area.—15 square miles.

Records available.—March 14, 1911, to September 30, 1913 (fragmentary); April 11 to September 2, 1916.

Gage.—Inclined staff on left bank. Vertical staff up to June 11, 1916. Gage reader, Prim Ortega.

Discharge measurements.—Made by wading.

Channel and control.—Sand; shifting; no defined control.

Extremes of discharge.—Maximum stage recorded during year and during period of records, 3.7 feet, May 25 (discharge, 77 second-feet). Creek dry beginning September 2.

Ice.—No record during winter.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve poorly defined. Gage read to half-tenths once a day with breaks. Daily discharge ascertained by applying daily gage height to rating table. Records poor.

Discharge measurements of Cucamonga Creek near Diamond, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 11	Hodges and Henshaw	2.06	14.6
May 5	P. V. Hodges	1.65	7.5
Oct. 26	Batchelder and Reineking	.52	.5

Daily discharge, in second-feet, of Cucamonga Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	4.5	10	......	0.7	0.1	16	10	5	5	2.2	.7	......
2	......	3.3	9	......	.7	0.0	17	7	4.5	6	2.7	1.0	......
3	......	3.3	8	......	.7	......	18	7	4	6	2.2	.7	......
4	......	6.0	8	......	.7	......	19	7	34	6	2.2	.7	......
5	......	7.5	8	4	.7	......	20	6	11	7	1.8	.5	......
6	......	8	8	4	.7	......	21	4	8	7	1.8	.5	......
7	......	8	8	6	.7	......	22	6	7	6	1.8	.3	......
8	......	10	8	7	.7	......	23	7	6	4	1.4	.3	......
9	......	10	8	7	.7	......	24	8	10	2.7	1.4	.2	......
10	......	8	9	5	.7	......	25	10	77	3	1.4	.2	......
11	14	8	8	4	.7	......	26	10	11	3.3	1.0	.2	......
12	10	6	7.5	4	.6	......	27	10	22	......	.8	.15	......
13	10	6	6	3.6	.7	......	28	10	16	......	.7	.15	......
14	10	6	6	3.3	.7	......	29	8	11	......	.7	.2	......
15	10	5	6	2.7	.7	......	30	6	10	......	1.0	.2	......
							31	......	11	......	.8	.15	......

Note.—Mean discharge estimated as 4 second-feet May 18; 10 second-feet May 24; 3 second-feet June 27–30, and 5 second-feet July 1–4. Daily discharge interpolated Apr. 22–24, 30; May 14, 18, 28; June 4, 19, 20, and 25.

Monthly discharge of Cucamonga Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 11-30	14	4	8.5	337
May	77	3.3	11.2	689
June	10	2.7	6.18	368
July		.7	3.05	188
August	1.0	.15	.53	33
The period				1,620

McCOY CREEK NEAR DIAMOND, OREG.

Location.—In sec. 12, T. 30 S., R. 32 E., about 1,000 feet above Kesterson's ranch house, and about 5 miles southwest of Diamond, Harney County.

Drainage area.—45 square miles (measured on special maps prepared by Garfield Stubblefield).

Records available.—May 23, 1910, to September 30, 1914; October 5 to 27, 1915; April 11 to September 2, 1916; also January 27 to June 30, 1909, on original gage, which was below some diversions.

Gage.—Vertical staff on right bank, installed August 7, 1913, 250 feet below that installed May 23, 1910. The original gage was 2½ miles farther downstream and 3 miles from Diamond post office. Gage reader, Prim Ortega.

Discharge measurements.—Made from a foot bridge 100 yards above present gage or by wading.

Channel and control.—Channel of clean gravel and sand; likely to shift. Control is a rock diversion dam at intake of Kesterson's ditch, which changes slightly in flood.

Extremes of discharge.—Maximum stage during year (observed June 10 from high-water marks), 4.0 feet, during night of June 5–6 (discharge, 190 second-feet); minimum stage recorded, 1.15 feet, October 6 to 12 (discharge, 2 second-feet).

1910–1916: Maximum stage recorded, 6.6, feet, during night of June 7, 1912 (discharge estimated from extension of rating curve as 300 second-feet); minimum discharge, 1.0 second-foot, September 1 to 4, 1911 (gage height, 1.6 feet), and July 26 to August 1, 1914 (gage height, 1.10 feet).

Ice.—No record during winter.

Diversions.—Above all diversions except one unimportant ditch.

Regulation.—None.

Accuracy.—Stage-discharge relation changed during high water of June. Well-defined rating curves used up to June 5 and beginning with June 21. Gage read to half-tenths once a day with occasional gaps. Daily discharge ascertained by applying daily gage height to rating table. Shifting control method used June 6 to 20. Records good.

Discharge measurements of McCoy Creek near Diamond, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	A. H. Page	1.17	2.6	May 5	P. V. Hodges	3.02	102
Dec. 29	do	[a] 1.37	2.8	24	do	2.20	48.5
Apr. 11	Hodges and Henshaw	2.14	43	June 10	do	3.30	120
May 4	P. V. Hodges	2.73	82				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of McCoy Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1				66		8.5	2.0
2				54		7.0	2.0
3				70		7.0	
4			84	86		7.0	
5	2.4		101	101	74	7.0	
6	2.0		117	129	53	7.0	
7	2.0		87	90	74	7.0	
8	2.0		87	129	81	7.0	
9	2.0		80	138	92	7.0	
10			66	124	74	7.0	
11	2.0	45	73	111	60	5.0	
12	2.0	36	69	98	60	5.0	
13	3.0	36	45	101	47	17.0	
14	3.0	26	73	101	47	7.0	
15	3.0	36	101	109	53	7.0	
16	3.0	26	57	113	47	7.0	
17	3.0	26	66	121	47	7.0	
18	3.0	26	76	113	34	6.0	
19	3.0	26	87	88	26	5.0	
20	3.0	26	80	63	21	7.0	
21	3.0	28	66	38	21	5.0	
22	3.0	30	57	56	17	5.0	
23	3.0	32	51	60	17	5.0	
24	3.0	34	48	70	13	5.0	
25	3.0	36	66	68	13	4.0	
26	3.0	36	60	67	13	3.0	
27	3.0		57		12	2.5	
28			65		10	2.5	
29			73		10	3.0	
30			80		10	3.0	
31			73		8.5	2.0	

NOTE.—Mean discharge estimated at 30 second-feet Apr. 27–30; 50 second-feet May 1–3; 60 second-feet June 27–30; 80 second-feet July 1–4.

Monthly discharge of McCoy Creek near Diamond, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 11–30	45	26	31.2	1,240
May	117	45	70.5	4,330
June	138	38	86.8	5,160
July	92	8.5	43.7	2,690
August	17	2.0	5.95	366
The period				13,800

BUENA VISTA CANAL NEAR NARROWS, OREG.

LOCATION.—In NE. ¼ sec. 26, T. 29 S., R. 31 E., at bridge over canal 300 feet below intake, opposite station on Donner und Blitzen River at "grain camp," about 25 miles south of Narrows, Harney County.

RECORDS AVAILABLE.—March 25 to June 7, 1915; April 7 to July 19, 1916.

GAGE.—Vertical staff on pier of bridge. Gage reader, J. A. Miller.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Canal is about 4 feet deep, excavated in a clayey material. A dam across canal about 1½ miles below gage causes backwater at times.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.1 feet June 9 (discharge, 148 second-feet). Canal dry at times.

1915–1916: Maximum stage recorded, 4.6 feet May 14, 1915 (discharge, 179 second-feet).

ICE.—Water turned out of canal during extremely cold weather.

ACCURACY.—Stage-discharge relation fairly permanent up to May 25; well defined rating curve used except May 23 to 25, when discharge was estimated. May 26 the dam, 1½ miles below, was put in to back water out over fields; discharge estimated up to June 8 and from June 14 to 30. Dam out June 9 to 13, and is assumed to have been out during July; open-water rating curve applied. Records good for April and May; fair for June and July.

This canal diverts water from left bank of Donner und Blitzen River, in the NE. ¼ sec. 26, T. 29 S., R. 31 E., to irrigate marsh hay lands on west side of Donner und Blitzen River.

Discharge measurements of Buena Vista canal near Narrows, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	Hodges and Henshaw..	2.85	56	May 23	P. V. Hodges..........	2.52	29.2
May 2	P. V. Hodges..........	3.26	85	June 10	.....do..................	3.65	113
4	.....do..................	3.75	118				

Daily discharge, in second-feet, of Buena Vista canal near Narrows, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		100		7	16	18	72		54
2		90		54	17	13	72		54
3		0		93	18	43	72		15
4		120		54	19	43	116		15
5		116		43	20	18	116		
6		116		29	21	13	60		
7	15	100		11	22	13	54		
8	40	108		0	23	29	23		
9	69	108	148	0	24	29	21		
10	57	100	116	72	25	18	21		
11	66	100	108	72	26	43			
12	66	96	108	79	27	48			
13	66	79	108	79	28	57			
14	60	79		79	29	54			
15	48	79		79	30	51			

NOTE.—Daily discharge estimated Apr. 7–8. Mean discharge estimated as 20 second-feet May 26–31, 10 second-feet June 1–8, and 5 second-feet June 14–30. These estimates very uncertain; discharge may have varied from zero to that given by open-channel rating. Canal dry prior to Apr. 7, on May 3, and July 8 and 9; no record after July 19; water probably turned out about that date.

Monthly discharge of Buena Vista canal near Narrows, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 7–30	69	13	40.7	1,940
May (30 days)	120		71.3	4,240
June	148		25.1	1,490
July 1–19 (17 days)	93	7	52.3	1,760
The period				9,430

SILVER CREEK ABOVE RILEY, OREG.

Location.—In NW ¼ sec. 30, T. 22 S., R. 26 E., at Cecil ranch, 3 miles below Nicholas Creek and about 12 miles above Riley, Harney County.

Drainage area.—260 square miles (measured on United States Reclamation Service maps).

Records available.—April 19, 1904, to July 14, 1906; February 16 to December 12, 1909; April 6 to October 19, 1910; flood periods of 1911, 1912, and 1914–1916.

Gage.—Vertical and inclined staffs on right bank, one-fourth mile above Cecil ranch house and 100 yards above point where creek divides into three channels. Gage reader, J. C. Cecil. Stevens water-stage recorder, installed temporarily, used April 8 to 22. Different gages used 1904 to 1906 and 1909 to 1910.

Discharge measurements.—Made by wading or from cable about 100 yards below the gage.

Channel and control.—Bed composed of clean gravel; slightly shifting; banks heavily covered with willows, which may affect stage-discharge relation somewhat.

Extremes of discharge.—Maximum stage recorded during year, 7.2 feet, at 8 a. m. March 19 (discharge, 698 second-feet). No record of minimum, which is very small.

1904–1906 and 1909–1916: Maximum stage recorded, 13.95 feet on original gage, observed from high-water mark April 14, 1904 (discharge, 1,760 second-feet). Stream bed dry in August and September, 1910.

Ice.—Stage-discharge relation affected by ice; no record during winter.

Diversions.—Practically no land irrigated above station.

Regulation.—None.

Accuracy.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read once daily to tenths and extremely high-water marks during night noted. Operation of recorder satisfactory until April 22, when float stuck in mud. Daily discharge ascertained by applying to rating table the daily gage height or the mean of the reading and the recorded peak. Records good for period for which gage record is available; estimate for yearly total fair.

Discharge measurements of Silver Creek above Riley, Oreg., during the year ended Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 19	R. D. Cooper	6.40	586
Apr. 8	P. V. Hodges	4.62	351
May 12	.....do	1.37	43.7

Daily discharge, in second-feet, of Silver Creek above Riley, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.
1	....	348	11	275	491	21	546	180
2	....	400	12	170	426	22	465	170
3	....	450	13	335	335	23	323	....
4	....	430	14	299	299	24	281	....
5	....	413	15	275	287	25	258	....
6	....	361	16	323	253	26	244	....
7	....	335	17	413	231	27	230	....
8	....	348	18	491	220	28	217	....
9	....	348	19	698	210	29	203	....
10	....	387	20	628	190	30	190	....
						31	269	....

Note.—Discharge interpolated Mar. 21, 26–29, and 31; estimated Apr. 2–4. Mean discharge Apr. 23 to 30, estimated 150 second-feet.

Monthly discharge of Silver Creek above Riley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 11-31	698	170	340	14,200
April	491		277	16,500
May			[a] 53	3,200
The period				34,000

[a] Estimated.

NOTE.—Total run-off for year about 36,000 acre-feet.

CATLOW VALLEY DRAINAGE BASIN.

HOME CREEK NEAR BECKLEY, OREG.

LOCATION.—In NE. ¼ sec. 10, T. 35 S., R. 32 E., at mouth of canyon, half a mile above Home Creek ranch buildings, 12 miles southeast of Beckley, and about 60 miles south of Narrows, Harney County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 21 to July 31, 1911; February 10 to July 31, 1912; April 1, 1915, to September 30, 1916.

GAGE.—Vertical staff on left bank; gage reader, Roy Haskin. A similar staff at practically the same site but different datum was used in 1911 and 1912.

DISCHARGE MEASUREMENTS.—Made from foot plank near gage or by wading. Conditions poor.

CHANNEL AND CONTROL.—Bed composed of heavy gravel and boulders; may shift in extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.4 feet May 25 (discharge, 104 second-feet); minimum stage recorded, 1.5 feet September 8, 9, and 16 (discharge, 0.1 second-foot; very uncertain; discharge seldom less than 1 second-foot).

1911-12 and 1915-16: Maximum stage recorded, 4.7 feet on old gage, April 27, 1912 (discharge, 330 second-feet); minimum is that of 1916.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—None above station; most of the water of the creek is used for flood irrigation on the hay lands of the Home Creek ranch.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during or after high water of 1915. New curve, fairly well defined by measurements made from November, 1915, to October, 1917, used beginning October 1. Gage read daily to half-tenths May 1 to September 10 and about three times a week rest of year, except April. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Home Creek near Beckley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 17	A. H. Page	1.84	1.5
17	do	1.84	1.7
May 3	P. V. Hodges	2.45	21.8

Daily discharge, in second-feet, of Home Creek near Beckley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May.	June.	July.	Aug.	Sept.
1	......	2.0	......	8	7	14	4	23	10	1.2	1.2
2	......	......	......	......	......	......	4	16	8	1.2	1.2
3	1.6	2.0	18	3	......	23	20	16	6	1.2	1.0
4	1.4	......	......	......	12	......	7	16	6	1.2	1.0
5	......	3.0	4	4	12	......	8	14	6	1.2	1.0
6	3.0	2.4	......	......	......	23	6	14	4	1.2	1.0
7	2.4	4.0	4	4	11	......	14	12	4	1.2	.9
8	2.4	......	......	......	......	20	14	12	4	1.2	.1
9	2.0	2.0	3	6	......	......	19	12	4	1.2	.1
10	1.2	......	......	......	11	29	18	12	3	1.2	.2
11	......	2.4	3	6	......	......	30	10	3	1.2	......
12	1.6	3.0	......	......	12	......	36	8	3	1.2	1.0
13	......	......	4	6	......	36	40	8	3	1.2	......
14	1.6	4.0	......	......	12	......	44	8	3	1.2	1.0
15	......	......	4	......	......	40	52	7	2	1.2	......
16	1.6	3.0	......	6	......	38	61	8	2	1.2	.1
17	......	1.5	4	......	18	......	52	8	3	2.0	......
18	1.2	......	......	7	......	40	56	8	3	2.0	1.0
19	......	7	3	......	23	23	61	10	3	2.0	1.0
20	1.2	......	......	7	20	......	71	7	3	3.0	.7
21	......	4	......	......	23	23	61	7	2	1.6	1.0
22	1.6	......	3	7	......	20	61	7	2	1.6	.3
23	2.0	......	......	......	......	......	56	7	2	1.6	.5
24	......	......	......	7	14	26	82	7	1.6	1.2	1.0
25	2.0	......	2	......	......	......	104	7	1.6	1.2	......
26	......	44	......	7	14	......	66	7	1.6	1.2	1.0
27	2.0	......	4	......	......	23	36	7	1.6	1.2	.7
28	......	......	......	......	20	29	29	7	1.6	1.2	......
29	2.4	......	3	7	......	......	20	7	1.6	1.2	1.0
30	......	10	......	......	......	26	18	8	1.2	1.0	......
31	......	44	......	......	......	......	18	......	1.2	1.0	......

NOTE.—No evidence that stage-discharge relation was affected by ice; open-channel rating applied throughout the winter. Rise Nov. 26 to Dec. 3 evidently caused by rain. Records for January and February may be slightly too large.

Monthly discharge of Home Creek near Beckley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3.0	1.2	1.8	111
November	44	1.5	8.6	512
December	18	2.0	4.5	277
January	7	3	5.7	350
February	23	7	15.0	863
March	40	14	27.1	1,670
April	......	......	[a] 15.0	893
May	104	4	37.7	2,320
June	23	7	10.0	595
July	10	1.2	3.3	203
August	3	1.0	1.4	86
September	1.2	.1	.8	48
The year	104	0.1	10.9	7,930

[a] Estimated.

NOTE.—Means for October to March and September determined from actual number of days for which discharge is given.

MISCELLANEOUS DISCHARGE MEASUREMENTS.

Discharge measurements of streams in the Great Basin at points other than regular gaging stations, made during the year ending September 30, 1916, are listed in the following table; also some measurements of canals in the Sevier Lake basin made during the year ending September 30, 1915.

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916				*Feet.*	*Sec.-ft.*
Apr. 16	Soda Springs Power canal.	Soda Creek	Soda Springs, Idaho		35.9
Sept. 16	Logan River	Bear River	About 100 feet below Utah Power & Light Co.'s tailrace and 200 feet below gaging station on Logan River above State dam.	[a] 0.97	164
17	do	do	do	.96	156
18	do	do	do	.98	157
19	do	do	do	.99	160
20	do	do	do	.98	158
21	do	do	do	.98	157
22	do	do	do	.97	154
26	do	do	do	.97	151
28	do	do	do	.98	154
8	do	do	150 feet below State dam; 2 miles east of Logan, Cache County, Utah; gage height from gage 100 feet downstream at former gaging station, Logan River below State dam.	1.36	161
9	do	do	do	1.35	160
10	do	do	do	1.36	162
10	do	do	do	1.36	161
11	do	do	do	1.36	165
12	do	do	do	1.35	161
12	do	do	do	1.34	157
13	do	do	do	1.34	156
16	do	do	do	1.35	159
17	do	do	do	1.34	160
18	do	do	do	1.34	156
19	do	do	do	1.34	154
20	do	do	do	1.33	154
21	do	do	do	1.31	150
22	do	do	do	1.31	151
29	do	do	do	1.26	144
June 25	Thaynes Canyon	East Canyon Creek	Sec. 8, T. 2 S., R. 4 E., Salt Lake meridian; above Sullivan's ranch; 1½ miles northwest of Park City, Summit County, Utah.		.8
25	do	do	Above Sullivan's springs		.4
25	do	do	Below Sullivan's springs		9.4
25	Hidden spring	Thaynes Canyon	About ¼ mile above Sullivan's ranch.		.3
25	Snyder's spring	do	About 1½ miles northwest of Park City, Utah.		.6
25	Hauter spring	do	Sec. 9, T. 2 S., R. 4 E., about ½ mile north of Park City, Utah.		12
1915					
Dec. 4	Middle Fork of Ogden River.	Ogden River	Sec. 11, T. 6 N., R. 1 E., Salt Lake meridian, at highway bridge 1½ miles west of Huntsville, Weber County, Utah.		25
4	South Fork of Ogden River.	do	Sec. 14, T. 6 N., R. 1 E., 1½ miles west of Huntsville, Utah, and ½ mile above junction of Middle and South Forks.		22
4	North Fork of Ogden River.	do	Sec. 10, T. 6 N., R. 1 E., 400 feet above road and 2 miles west of Huntsville, Utah.		10
Nov. 6	Jordan River	Great Salt Lake	Sec. 35, T. 4 S., R. 1 W. Salt Lake meridian, at the impounding dam just above Jordan narrows, about 5 miles northwest of Lehi, Utah County, Utah.		159

[a] Temporary gage installed for this set of measurements.

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Sevier Lake basin.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916.				*Feet.*	*Sec.-ft.*
June 28	Sevier River	Sevier Lake	SE. ¼ sec. 28, T. 34 S., R. 5 W., below heading of East Panguitch canal, about a mile east of Panguitch, Utah.		102
Sept. 12	do	do	do		61
June 28	do	do	NW. ¼ sec. 9, T. 34 S., R. 5 W., below heading of old Houston canal, about 3½ miles NE. of Panguitch, Utah.		102
July 11	do	do	do		68
Aug. 9	do	do	do	4.39	274
18	do	do	do	4.03	187
Sept. 12	do	do	do	3.64	86
Aug. 15	do	do	NE. ¼ sec. 33, T. 24 S., R. 3 W., 200 feet below heading of Annabella canal, about a mile southeast of Elsinore, Utah.		27
Jan. 22	do	do	NW. ¼ sec. 32, T. 23 S., R. 2 W., 200 feet below heading of Vermilion canal, about 2½ miles east of Richfield, Utah.		48
22	do	do	NW. ¼ sec. 31, T. 22 S., R. 1 W., above backwater of Rockyford reservoir, about ¾ mile east of Sigurd, Utah.		152
Aug. 14	do	do	do		210
Feb. 17	do	do	NE. ¼ sec. 22, T. 16 S., R. 2 W., ¼ mile above upper Mollen Spring, 3 miles NW. of Sevier Bridge dam, 6½ miles south of Mills, Utah.		7.8
17	do	do	SW. ¼ sec. 11, T. 16 S., R. 2 W., ¼ mile below lower Mollen Spring, about 4½ miles NW. of Sevier Bridge dam and 5 miles south of Mills, Utah.		39
16	do	do	NW. ¼ sec. 23, T. 15 S., R. 2 W., about 200 feet below railroad bridge near Mills, Utah.		54
1915.					
Oct. 6	South Fork Mammoth Creek.	Mammoth Creek	SE. ¼ sec. 27, T. 36 S., R. 8 W., about 7 miles southwest of Blue Spring Fish Hatchery and 30 miles southwest of Panguitch, Utah.	.10	.6
1916.					
Aug. 19	do	do	do	.35	2.8
1915.					
Oct. 7	Mammoth Creek	Sevier River	SE. ¼ sec. 26, T. 36 S., R. 8 W., about 3 miles south of Blue Spring Fish Hatchery, ½ mile below junction of Castle Creek and South Fork of Mammoth Creek, and 30 miles southwest of Panguitch, Utah.	.83	4.8
Dec. 9	do	do	do	.78	3.1
1916.					
Feb. 26	do	do	do	.72	3.0
Apr. 2	do	do	do	.80	3.7
Aug. 19	do	do	do	.88	6.1
1915.					
Dec. 9	do	do	NE. ¼ sec. 36, T. 36 S., R. 8 W., about 3 miles southeast of Blue Spring, 1 mile below junction of Castle Creek and South Fork of Mammoth Creek, and 30 miles southwest of Panguitch, Utah.		3.2
1916.					
June 1	Barnhurst ditch	Mammoth Creek	SW. ¼ sec. 31, T. 36 S., R. 5 W., about 1 mile west of Hatchtown dam, 2½ miles southwest of Hatch, Utah.		7.9
1	do	do	do		6.5
July 11	East Bench canal	Long canal	W. ½ sec. 2, T. 35 S., R. 5 W., 100 feet below Long canal gaging station and 3½ miles southeast of Panguitch, Utah.	.64	7.1

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Sevier Lake basin—Continued.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1916. Aug. 19	Panguitch Lake Feeder canal.	Blue Spring Creek...	SE. ¼ sec. 14, T. 36 S., R. 8 W., about 1 mile below heading, 5 miles southwest of Blue Springs, and 28 miles southwest of Panguitch, Utah.	0.84	3.3
1915. Dec. 10	Blue Spring..........	.....do...............	Near center of sec. 7, T. 36 S., R. 7 W., at Blue Spring Fish Hatchery, 23 miles southwest of Panguitch, Utah.	....	4.2
8	Panguitch Creek.....	Sevier River........	NE. ¼ sec. 34, T. 35 S., R. 7 W., about 100 yards below Panguitch Lake dam and about 15 miles southwest of Panguitch, Utah.	....	0.1
1916 Aug. 19	......do............	.....do...............	......do..........................	.53	23.0
May 20	Vaeter canal.........	.....do...............	SW. ¼ sec. 10, T. 33 S., R. 5 W., at head near Panguitch, Utah.	.36	1.5
29	.....do............	.....do...............	.....do..........................	.49	1.7
June 15	.....do............	.....do...............	.....do..........................	.70	4.6
July 1	.....do............	.....do...............	.....do..........................	.70	5.7
14	.....do............	.....do...............	.....do..........................	.58	3.7
27	.....do............	.....do...............	.....do..........................	1.38	11.3
Aug. 11	.....do............	.....do...............	.....do..........................	.90	8.3
25	.....do............	.....do...............	.....do..........................	.86	6.7
1916. May 10	.....do............	.....do...............	.....do..........................	.98	7.8
June 2	.....do............	.....do...............	.....do..........................	1.02	9.2
28	.....do............	.....do...............	.....do..........................	.83	8.8
July 11	.....do............	.....do...............	.....do..........................	.60	6.9
31	.....do............	.....do...............	.....do..........................	1.38	11.0
1915 Dec. 6	Otter Creek reservoir feeder canal.	East Fork Sevier River.	NW. ¼ sec. 15, T. 31 S., R. 2 W., near head of canal, ¼ mile southwest of Coyoto schoolhouse.	....	48
6	East Fork Sevier River.	Sevier River........	NW. ¼ sec. 15, T. 31 S., R. 2 W., about 300 yds. below canal heading, and ½ mile southwest of Coyoto schoolhouse.	....	4.5
6	Otter Creek reservoir seepage ditch.	East Fork Sevier River.	NW. ¼ sec. 28, T. 30 S., R. 2 W., about 200 feet above Otter Creek reservoir outlet, and 12 miles east of Kingston Utah.	....	5.1
1916 Jan. 2	.....do............	.....do...............	.....do..........................	....	6.4
July 1	Booby Hole Creek...	Otter Creek..........	Near center of T. 25 S., R. 1 E., at N. McMillan's ranch about 25 miles southeast of Richfield, and 5 miles northeast of Burrville, Utah.	....	.9
May 12	Allen ditch..........	East Fork Sevier River.	NE. ¼ sec. 15, T. 30 S., R. 3 W., 100 feet south of Kingston canal station at edge of town of Kingston, on road leading to Coyoto, Utah.	....	5.8
Aug. 10	.....do............	.....do...............	.....do..........................	....	4.5
June 12	.....do............	.....do...............	.....do..........................	....	3.9
16	Cottonwood Creek...	Sevier River........	Approximately in sec. 13, T. 28 S., R. 4 W., about 1 mile above plant of Mineral Products Co., and 7 miles southwest of Marysvale, Utah.	....	43
Sept. 14	.....do............	.....do...............	.....do..........................	....	3.7
May 17	Sevier Valley canal..	Sevier River........	NW. ¼ sec. 21, T. 24 S., R. 3 W., at highway bridge north edge of town of Elsinore, Utah.	....	265
Aug. 14	State canal..........	Continuation of Sevier Valley canal.	SE ¼ sec. 12, T. 22 S., R. 2 W., end of district No. 1, about 2 miles southwest of Aurora, Utah.	2.14	148
June 20	.....do............	.....do...............	SE. ¼ sec. 20, T. 21 S., R. 1 W., at flume of State canal over Denmark Wash about 3 miles west of Salina, Utah.	4.80	164
July 17	.....do............	.....do...............	.....do..........................	4.80	169
19	.....do............	.....do...............	.....do..........................	2.75	73

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Sevier Lake basin—Continued.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916.				*Feet.*	*Sec.-ft.*
June 20	State canal	Construction of Sevier Valley canal.	NW. ¼ sec. 3, T. 21 S., R. 1 W., end of district No. 2, about 2 miles west of Redmond, Utah.	1.75	153
July 26	Brown ditch	State canal	SW. ¼ sec. 11, T. 20 S., R. 1 W., about ½ mile north of station on State canal, 5 miles northwest of Redmond, Utah.		9.3
Jan 22	Drain ditch	Sevier River	NW. ¼ sec. 32, T. 23 S., R. 2 W., 200 feet below Vermillion canal heading about 2½ miles east and ¾ mile south of courthouse, Richfield, Utah.		16
Mar. 23	Black Knoll Spring	do	NE. ¼ sec. 1, T. 23 S., R. 2 W., at Black Knoll ranch, about 1 mile south of Sigurd, Utah.		4.9
June 19	Salina Irrigation Co. canal.	Salina Creek	SE. ¼ sec. 25, T. 21 S., R. 1 W., immediately below measuring weir and waste gate, about 1½ miles southeast of White House Hotel, Salina, Utah.		57
Apr. 5	Drain No. 5	Sevier River	T. 19 S., R. 1 W., between State road Centerfield to Westview on the south, and San Pitch River on north, about 2 miles west of Centerfield, Utah.		.3
5	Drain No. 4	do	do		6.1
5	Drain No. 3	do	do		1.1
5	Drain No. 2	do	do		.5
5	Drain No. 1	do	do		4.0
May 11	Kearns ditch	Dover canal	SE. ¼ sec. 23, T. 19 S., R. 1 W., 50 feet below head which is between Dover canal gage and weir near Gunnison, Utah.		5.3
May 10	East Branch of Wellington canal.	Sevier River	NW. ¼ sec. 34, T. 15 S., R. 2 W., about 200 feet below heading and 2½ miles southwest of Mills, Utah.		12
Jan. 23	Chicken Creek	do	NW. ¼ sec. 26, T. 15 S., R. 2 W., about ½ mile southeast of Mills, Utah.		4.4
Feb. 16	do	do	do		8.8
May 3	Canal B	Canal A	Sec. 31, T. 16 S., R. 6 W., 250 feet below heading and 1½ miles north of Delta, Utah.	4.43	296
3	do	do	do	4.44	304
4	do	do	do	4.50	303
10	do	do	do	3.78	241
3	do	do	SE. ¼ sec. 25, T. 16 S., R. 7 W., at flume over river about 1¼ miles below head of canal, and about 2 miles north of Delta, Utah.		298
3	Canal B	Canal A	Between secs. 34 and 35, T. 16 S., R. 7 W., about 4 miles northwest of Delta, Utah.		294
4	Canal B 5	Canal B	NE. ¼ sec. 22, T. 16 S., R. 7 W., at head near Woodrow, Utah.		124
4	do	do	Corner of secs. 9, 10, 15, and 16, T. 16 S., R. 7 W., at Tracy Bridge, Woodrow, Utah.		113
4	Canal B 6	do	SE. corner of sec. 10, T. 16 S., R. 7 W., 150 feet below head, 1 mile east of Woodrow, Utah.		59
4	do	do	do		100
5	do	do	do		56
6	do	do	do		58
July 13	do	do	do		62
13	do	do	do		65
May 6	do	do	NW. ¼ SW. ¼ sec. 26, T. 15 S., R. 7 W., station 293+22, 5 miles below head, near Sugarville, Utah.		44
July 13	do	do	do		51
May 6	do	do	On line between secs. 9 and 16, T. 15 S., R. 7 W., at Carbury's ranch, near Sugarville, Utah.		24
July 13	do	do	do		48

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Sevier Lake basin—Continued.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1916.					
July 13	Lateral B 6 E	Canal B 6	SW. ¼ sec. 16, T. 15 S., R. 7 W., 50 feet below head gates near Sugarville, Utah.		4.7
May 5	Canal B 9	Canal B	SW. ¼ sec. 34, T. 15 S., R. 7 W., 60 feet below head, 2½ miles southeast of Sugarville, Utah.		35
6	do	do	do		30
5	do	do	NW. ¼ sec. 21, T. 15 S., R. 7 W., 2 miles north of Sugarville, Utah.		17
6	do	do	do		24
10	Canal C	Canal A	Sec. 31, T. 16 S., R. 6 W., about 200 feet below head gates and 1½ miles north of Delta, Utah.	2.77	76
1914.					
Oct. 11	Midland canal	Abraham canal	SW. ¼ sec. 10, T. 17 S., R. 7 W., 75 feet below head of canal, and 3½ miles west of Delta, Utah.	4.27	4.6
1915.					
May 21	do	do	do	4.38	6.4
June 25	do	do	do	4.66	9.7
July 16	do	do	do	4.21	3.9
23	do	do	do	4.28	4.2
30	do	do	do	4.40	5.1
Aug. 3	do	do	do		.0
21	do	do	do		.0
Sept. 3	do	do	SW. ¼ sec. 10, T. 17 S., R. 7 W., 75 feet below head of canal and 3½ miles west of Delta, Utah.		.0
Oct. 8	do	do	do	4.49	6.9
1916.					
Apr. 28	do	do	do	4.80	12.0
May 15	do	do	do	5.20	18.0
22	do	do	do	4.98	15.0
30	do	do	do	4.99	14.0
June 7	do	do	do	4.71	9.4
1915.					
Oct. 8	Abraham canal	Sevier River	SW. ¼ sec. 10, T. 17 S., R. 7 W., about 600 feet below head of canal, 3½ miles west of Delta, Utah.	4.39	26.1
25	do	do	do	4.78	29.9
Nov. 3	do	do	do	5.10	43.5
13	do	do	do	4.73	34.8
18	do	do	do	4.69	16.9
1916.					
Mar. 27	do	do	do	3.93	4.50
Apr. 28	do	do	do	5.89	87.6
May 15	do	do	do	6.39	136.3
22	do	do	do	5.88	99.0
30	do	dot	do	5.56	73.0
June 8	do	do	do	5.98	89.0
20	do	do	do	5.92	71.3
30	do	do	do	6.24	66.5
July 10	do	do	do	6.25	79.9
28	do	do	do	6.01	68.6
Aug. 31	do	do	do	5.18	34.9
Sept. 5	do	do	do	4.75	20.5
22	do	do	do	4.91	10.1
1915.					
Oct. 8	Deseret High Line canal.	do	Sec. 15, T. 17 S., R. 7 W., 400 feet below head of canal, about 3 miles west of Delta, Utah.	4.30	23.2
25	do	do	do	4.46	31.8
Nov. 3	do	do	do	4.62	29.0
13	do	do	do	4.61	25.6
18	do	do	do	3.90	8.54
1916.					
Mar. 31	do	do	do	3.86	20.1
Apr. 8	do	do	do	5.27	21.5

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Sevier Lake basin—Continued.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916.				*Feet.*	*Sec.-ft.*
Apr. 21	Deseret High Line canal.	Sevier River	Sec. 15, T. 17 S., R. 7 W., 400 feet below head of canal, about 3 miles west of Delta, Utah.	4.40	18.1
28	do	do	do	5.12	76.2
May 8	do	do	do	5.83	117
15	do	do	do	5.99	115
22	do	do	do	4.66	23.8
28	do	do	do	5.10	39.9
June 8	do	do	do	6.15	61.8
20	do	do	do	5.88	71.2
30	do	do	do	5.88	56.9
July 10	do	do	do	5.46	56.5
28	do	do	do	4.61	30.0
Aug. 31	do	do	do	5.23	30.8
Sept. 6	do	do	do	4.93	26.6
22	do	do	do	4.39	28.5
1915.					
Oct. 8	Deseret canal	do	SE. ¼ sec. 15, T. 17 S., R. 7 W., 300 feet below head of canal, about 2½ miles west of Delta, Utah.	4.35	48.2
27	do	do	do	4.70	45.8
Nov. 3	do	do	do	4.67	34.8
13	do	do	do	4.70	39.8
18	do	do	do	4.66	29.9
1916.					
Mar. 27	do	do	do	4.86	47.5
31	do	do	do	4.86	57.5
Apr. 21	do	do	do	4.30	89.6
28	do	do	do	4.39	103.0
May 8	do	do	do	4.68	124.0
15	do	do	do	4.39	96.3
22	do	do	do	4.26	75.1
June 7	do	do	do	4.44	84.7
20	do	do	do	4.23	97.9
30	do	do	do	4.54	66.4
July 10	do	do	do	4.80	85.9
28	do	do	do	4.66	45.2
Aug. 31	do	do	do	4.29	38.4
Sept. 5	do	do	do	4.35	43.3
22	do	do	do	3.98	30.5

Beaver River basin.

1916.					
Sept. 15	Beaver River		NW. ¼ sec. 11, T. 30 S., R. 9 W., at approximate site of gage established June 1 for gaging station Beaver River below Rockyford dam, near Minersville, Utah.		6.2
15	do		NW. ¼ sec. 7, T. 30 S., R 9 W., 300 feet above heading of Minersville canal, 1½ miles east of Minersville, Beaver County, Utah.		6.5

Minor basins in Nevada.

1916.					
June 22	Lehman Creek	Snake Valley	Sec. 10, T. 13 N., R. 69 E., Mount Diablo meridian, ½ mile above ranch house, and 5 miles west of Baker, White Pine County, Nev.		4.5
22	Baker Creek	Lehman Creek	Sec. 14, T. 13 N., R. 69 E., Mount Diablo meridian, at former gaging station Baker Creek, near Baker, Nev.	1.80	39
22	Canal	Baker Creek	Near old gaging station on Baker Creek. Flow should be added to that of Baker Creek to get total in creek above diversions.		7.8

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Minor basins in Nevada—Continued.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916.				*Feet.*	*Sec.-ft.*
June 24	White River	White River Valley.	Former gaging station White River near Preston, Nev.	0.8	4.2
24	Preston Springs	White River	Flume where stream is divided between the towns of Preston and Lund. About 1 mile northwest of Preston, Nev.		8.0
24	Spring	Lund Canal	Road crossing 100 feet below spring near school house in Preston.		3.4
May 5	Duckwater canal	Big Warm Spring	20 feet below headgate, 1,000 feet below Big Warm Spring, near Duckwater.		.8
5	do	do	100 feet above Tognoni's weir		.9
Aug. 25	Tognoni's canal	do	20 feet below Tognoni's weir		1.3
May 5	Overflow from Tule Swamp.	do	Head of feeder canal to Duckwater Canal.		1.8
Aug. 25	do	do	Weir ¼ mile below head of feeder canal.		1.6
1915 Nov. 21	Little Warm Spring.	Little Warm Spring.	150 feet below spring and above Tule Swamp, near Duckwater.		2.7
21	do	do	300 feet below weir just below Tule Swamp.		2.8
1916 Aug. 25	East Fork Duckwater Creek.	Duckwater Creek	Near junction with Duckwater Creek in sec. 36, T. 14 N., R. 56 E.		5.3
			Walker Lake basin.		
1915. Dec. 17	Sprague canal	Walker River	100 feet below headgate, 300 feet below highway bridge across Walker River, at Mason, Nev.		15
1916 Jan. 14	do	do	do		5.2
			Humboldt River basin.		
1916. June 20	Secret Creek	Lamoille Creek	Sec. 2 T. 34 N., R. 59 E., opposite mouth of abandoned mine tunnel, 14 miles southeast of Halleck, Nev.		16
Mar. 22	Pine Creek	Humboldt River	Former gaging station, Pine Creek, near Palisade, Nev.	2.20	155
June 5	do	do	do		1.9
15	Rock Creek	do	Overland trail, highway bridge at mouth of canyon, 25 miles northeast of Battle Mountain, Nev.		14
			Pyramid and Winnemucca lakes basin.		
1916. June 6	Galena Creek	Steamboat Creek	Former gaging station, Galena Creek, near Washoe, Nev.		41
			Honey Lake basin.		
1916. Feb. 6	Janesville Creek	Baxter Creek	SW. ¼ sec. 9, T. 29 N., R. 13 E., at abandoned U. S. Geological Survey station, 50 feet from old Masonic building, at Janesville, Cal.	1.35	0.8
			Abert Lake basin.		
1915. Oct. 3	Ana River	Summer Lake	SE. ¼ sec. 6, T. 30 S., R. 17 E., near Summer Lake, Oreg.		132

Miscellaneous discharge measurements in Great Basin during the year ending Sept. 30, 1916—Continued.

Malheur Lake basin.

Date.	Stream.	Tributary to or diverts from—	Locality.	Gage height.	Discharge.
1916.				*Feet.*	*Sec.-ft.*
Apr. 14	Silvies River	Malheur Lake	Canyon City road, northeast of Burns.	0.00	1,040
May 1	do	do	do	−1.00	660
19	do	do	do	−1.92	354
June 1	do	do	do	−1.96	337
15	do	do	do	−2.28	174
Apr. 14	Foley Slough	Defluent of Silvies River.	do		837
May 1	do	do	do		311
6	do	do	do		202
19	do	do	do		52
June 1	do	do	do		58
15	do	do	do		0
Apr. 14	Whiting Slough	do	do		250
May 1	do	do	do		122
19	do	do	do		33.6
June 1	do	do	do		28.5
15	do	do	do		0
Apr. 14	Poison Slough	do	Sec. 32, T. 22 S., R. 31 E., northeast of Burns.		47.2
May 1	do	do	do		[a] 17.5
19	do	do	do		[a] 2.7
June 1	do	do	do		[a] 2.0
15	do	do	do		0
9	Warm Springs	Donner und Blitzen River.	Sec. 12, T. 32 S., R. 32 E., on "P" Ranch.		1.4
May 4	East side ditch	do	Gram camp in sec. 26, T. 29 S., R. 31 E.	4.32	8.2
June 10	do	do	do	4.31	8.3

[a] Estimated.

Harney Lake basin.

1916.					
Apr. 12	Silver Creek	Harney Lake	Near mouth		83
13	do	do	do		91
24	do	do	do		26
May 1	do	do	do		0
Apr. 24	Unnamed ditch	Silver Creek	Sec. 27, T. 26 S., R. 29 E		12
13	"OO" Spring	Harney Lake	Sec. 34, T. 26 S., R. 28 E		15.8
May 14	do	do	do		15.7
Apr. 12	"OO" barn yard spring.	do	Sec. 36, T. 26 S., R. 28 E		6.6
May 15	do	do	do		5.8
Apr. 12	East "OO" spring	do	do		2.1
May 15	do	do	do		2.7
Apr. 12	Johnson Spring	do	Sec. 6, T. 27 S., R. 29 E		1.5
12	Hughet Spring	do	Sec. 10, T. 27 S., R. 29 E., 1 mile below head.		13.6
24	do	do	do		9.2
12	Sizemore upper spring.	do	Sec. 9, T. 27 S., R. 29 E		1.5
May 14	do	do	do		2.1
Apr. 12	Sizemore lower spring.	do	NW. ¼ sec. 15, T. 27 S., R. 29 E.		1.4
May 14	do	do			1.6
Apr. 12	"OO" drainage canal	do	About sec. 3, T. 27 S., R. 29 E.		16.1
24	do	do	do		12.9
May 1	do	do	do		0

Catlow Valley.

1916.					
Nov. 17	Roaring Springs	Sink	Roaring Springs ranch, in sec. 6, T. 34 S., R. 32 E.		5.8
May 4	do	do	do		6.7

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STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART X. THE GREAT BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, monographs, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below.

Part I. North Atlantic slope basins.
II. South Atlantic and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins, in three volumes:
    A. Pacific slope basins in Washington and upper Columbia River basin.
    B. Snake River basin.
    C. Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office. Washington, D. C., who will furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., Room 704, Journal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Boise, Idaho, 615 Idaho Building.
Helena, Mont., Montana National Bank Building.
Topeka, Kans., 25 Federal Building.
Austin, Tex., Capitol Building.
Denver, Colo., 403 New Post Office Building.
Tucson, Ariz., University of Arizona.
Salt Lake City, Utah, 421 Federal Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, 14 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,100 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.

Stream-flow data in reports of the United States Geological Survey—Continued.

[A—Annual Report; B—Bulletin; W—Water-Supply Paper.]

Report.	Character of data.	Year.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907-8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The table which follows gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1916. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Maine, 1903 to 1916, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are taken up in order of streams around the rim of the lake.

Numbers of water-supply papers containing results of stream measurements, 1899-1916.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII North Pacific slope basins.		
	North Atlantic slope basins (St. John River to York River).	South Atlantic and eastern Gulf of Mexico basins (James River to the Mississippi).	Ohio River basin.	St. Lawrence River and Great Lakes basins.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington and upper Columbia River basin.	Snake River basin.	Lower Columbia River basin and Pacific slope basins in Oregon.
1899 a	35	b 35, 36	36	36	36	c 36, 37	37	37	d 37, 38	38, e 39	38, f 39	38	38	38
1900 g	47, h 48	48	48, i 49	49	49	49, j 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	k 65, 66, 75	66, 75	k 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	b 82, 83	83	l 82, 83	k 83, 85	84	k 83, 84	84	85	85	85	85	85	85
1903	97	b 97, 98	98	97	k 98, 99, m 100	99	k 98, 99	99	100	100	100	100	100	100
1904	n 124, o 125, p 126	p 126, 127	128	129	k 128, 130	130, q 131	k 128, 131	132	133	133, r 134	134	135	135	135
1905	n 165, o 166, p 167	p 167, 168	169	170	171	172	k 169, 173	174	175, s 177	176, r 177	177	178	178	t 177, 178
1906	n 201, o 202, p 203	p 203, 204	205	206	207	208	k 205, 209	210	211	212, r 213	213	214	214	214
1907-8	241	242	243	244	245	246	247	248	249	250, r 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, r 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332-A	332-B	332-C
1913	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444

[a] Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables for monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Gallatin River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific slope drainage basins.

[g] Rating tables and index to Water-Supply Papers 47-52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables for monthly discharge mates for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Scioto River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

PART X. THE GREAT BASIN.

PRINCIPAL DIVISIONS.

The Great Basin is made up of a number of minor basins whose streams do not discharge into the ocean. The largest of these minor basins are the depressions that hold Great Salt Lake, Sevier Lake, Humboldt Sink, Truckee, Walker, Carson, and Owens rivers, and Honey, Mono, Malheur, Harney, Warner, Abert, Summer, and Silver lakes. The streams of this section drain wholly or in part the States of California, Idaho, Nevada, Oregon, Utah, and Wyoming.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations (see p. XXIV).

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1916. Period after a date indicates discontinuance.

GREAT SALT LAKE BASIN.

- Great Salt Lake at Saltair, Utah, 1904; 1912–
- Great Salt Lake at Midlake, Utah, 1912–
- Great Salt Lake at Garfield Beach gage, Utah, 1875–1899.
    - Bear River near Evanston, Wyo., 1913–
    - Bear River near Harer, Idaho, 1913–1916.
    - Bear River at Dingle, Idaho, 1903–1914.
    - Bear River at Soda Springs, Idaho, 1896.
    - Bear River at Alexander, Idaho, 1911–1916.
    - Bear River near Preston, Idaho, 1889–
    - Bear River near Collinston, Utah, 1889–
        - Bear (Mud) Lake inlet canal near Dingle, Idaho, 1911–1913.
        - Bear Lake at Fishaven, Idaho, 1903–1906.
        - Georgetown Creek near Georgetown, Idaho, 1911–1914.
        - Soda Creek near Soda Springs, Idaho, 1913–
        - Cub Creek near Franklin, Idaho, 1900–1901.
        - Logan River above State dam, near Logan, Utah, 1913–
        - Logan River near Logan, Utah, 1896–1912.
        - Logan River below State dam, near Logan, Utah, 1913–14.
        - Logan River below Logan Northern canal, near Logan, Utah, 1915–
            - Utah Power & Light Co.'s tailrace near Logan, Utah, 1913–
            - Logan, Hyde Park, and Smithfield canal near Logan, Utah, 1904–1907; 1909–
            - Logan Northern canal near Logan, Utah, 1913–1916.
            - Blacksmith Fork above Utah Power & Light Co.'s dam, near Hyrum, Utah, 1900–1902; 1913–
            - Blacksmith Fork at Utah Power & Light Co.'s plant, near Hyrum, Utah, 1914–

- Great Salt Lake—Continued.
  - Bear River tributaries—Continued.
    - Logan River—Continued.
      - Blacksmith Fork below Utah Power & Light Co.'s plant, near Hyrum, Utah, 1904–1910; 1914–
        - Hyrum city power canal (Blacksmith Fork power-plant race) near Hyrum, Utah, 1904–1910; 1914–
    - West Side canal near Collinston, Utah, 1912–
    - Hammond (East Side) canal near Collinston, Utah, 1912–
    - Little Malad River near Malad, Idaho, 1911–1913.
    - Box Elder Creek at Brigham, Utah, 1909–1912.
  - Weber River near Oakley, Utah, 1904–
  - Weber River at Devils Slide (Croydon), Utah, 1905–
  - Weber River near Uinta, Utah, 1889–1903.
  - Weber River near Plain City, Utah, 1903–
    - Chalk Creek at Coalville, Utah, 1904–5.
    - Lost Creek near Croydon, Utah, 1905.
    - Ogden River at upper end of canyon, near Ogden, Utah, 1895–6.
    - Ogden River at Utah Light & Railway Co.'s dam, near Ogden, Utah, 1904–1912.
    - Ogden River at powder mill, near Ogden, Utah, 1889–90; 1897–1899.
  - Mill Creek near Bountiful, Utah, 1913–14.
  - Jordan River near Lehi, Utah, 1904; 1913–
    - Utah Lake near Spanish Fork, Utah, 1889–1896.
    - Utah Lake at Geneva, near outlet, Utah, 1896–1900.
      - Summit Creek near Santaquin, Utah, 1905; 1910–
      - Peteetneet Creek near Payson, Utah, 1910–
      - Spanish Fork at Thistle, Utah, 1907–
      - Spanish Fork near Spanish Fork (Mapleton), Utah, 1900–1901; 1903–
      - Spanish Fork at Lake Shore, Utah, 1903–1907; 1909–
        - Diamond Fork near Thistle, Utah, 1907–
        - United States Reclamation Service power canal near Spanish Fork, Utah, 1909–
      - Hobble Creek near Springville, Utah, 1904–1916.
      - Maple Creek near Springville, Utah, 1910–1913.
      - Provo River at Forks, Utah, 1911–
      - Provo River above Telluride Power Co.'s dam, near Provo, Utah, 1905–1911.
      - Provo River at mouth of canyon, near Provo, Utah, 1889–1906.
      - Provo River at Denver & Rio Grande Railroad bridge, near Provo, Utah, 1905.
      - Provo River at San Pedro, Los Angeles & Salt Lake Railroad bridge, near Provo, Utah, 1903–4.
        - South Fork of Provo River at Forks, Utah, 1911–
      - American Fork above South Fork, near American Fork, Utah, 1912–1915.
      - American Fork near American Fork, Utah, 1900–1901; 1903–1905.
        - South Fork of American Fork near American Fork, Utah, 1912–1915.
    - Little Cottonwood Creek near Salt Lake City, Utah, 1898–1913.
    - Big Cottonwood Creek near Salt Lake City, Utah, 1898–1913.
    - Mill Creek near Salt Lake City, Utah, 1898–1913.
    - Parleys Creek near Salt Lake City, Utah, 1898–1913.
      - Emigration Creek near Salt Lake City, Utah, 1898–1913.
    - City Creek near Salt Lake City, Utah, 1898–1913.

SEVIER LAKE BASIN.

- Mammoth Creek (head of Sevier River) near Hatch, Utah, 1912; 1913–14; 1915–
- Sevier River at Hatch, Utah, 1911–
- Sevier River near Panguitch, Utah, 1914.
- Sevier River below Old Houston canal near Panguitch, Utah, 1916.
- Sevier River near Circleville, Utah, 1912; 1914–
- Sevier River near Kingston, Utah, 1914–
- Sevier River near Junction, Utah, 1911; 1912–1916.
- Piute reservoir near Marysvale, Utah, 1914–
- Sevier River below Piute dam, near Marysvale, Utah, 1911; 1912–
- Sevier River at Pitts ranch, near Marysvale, Utah, 1906–1911.
- Sevier River at Marysvale, Utah, 1912–1914.
- Sevier River at Sevier, Utah, 1911–
- Sevier River near Richfield, Utah, 1916–
- Sevier River at Joseph, Utah, 1889.
- Sevier River near Vermilion, Utah, 1912; 1914–
- Sevier River near Gunnison, Utah, 1900–
- Sevier River at Clarks bridge, near Fayette, Utah, 1914–1916.
- Sevier River at McArtie's Ford, near Fayette, Utah, 1914; 1915.
- Sevier Bridge reservoir near Juab, 1914–
- Sevier River near Juab, Utah, 1911–
- Sevier River near Mills, Utah, 1914–
- Sevier River at Leamington, Utah, 1889–1898; 1912–1914.
- Sevier River near Lynndyl, Utah, 1914–
- Delta and Melville reservoir near Delta, Utah, 1914–
- Sevier River near Delta, Utah, 1912; 1913–
- Gunnison Bend reservoir near Delta, Utah, 1914–
- Sevier River at Oasis, Utah, 1913–
  - Hatch Bench canal near Hatch, Utah, 1914; 1916–
  - Asay Creek near Hatch, Utah, 1912; 1913–14.
  - State canal near Panguitch, Utah, 1913; 1914–
  - Long canal near Panguitch, Utah, 1914–
  - East Panguitch canal near Panguitch, Utah, 1914–
  - Panguitch Creek above canals near Panguitch, Utah, 1915–
  - Barton and LeFevre canal near Panguitch, Utah, 1915–
  - McEwen canal near Panguitch, Utah, 1914–
  - Old Houston canal near Panguitch, Utah, 1915–
  - Fox canal near Circleville, Utah, 1914–
  - Circleville canal near Circleville, Utah, 1914–
  - Old Kingston canal near Circleville, Utah, 1914–
  - Dalton canal at Circleville, Utah, 1914–
  - Mitchell Slough:
    - Mitchell Slough canal near Junction, Utah, 1914–
  - Junction Middle canal near Junction, Utah, 1915–
  - East Fork of Sevier River at Coyoto, Utah, 1914–
  - East Fork of Sevier River above Otter Creek, near Coyoto, Utah, 1915–16.
  - East Fork of Sevier River near Kingston, Utah, 1912–
  - East Fork of Sevier River at Junction, Utah, 1913.
    - Coyoto canal near Coyoto, Utah, 1916–
    - Otter Creek above reservoir, near Coyoto, Utah, 1915–
    - Otter Creek reservoir near Coyoto, Utah, 1914.
    - Otter Creek reservoir canal near Coyoto, Utah, 1914–
    - Otter Creek near Coyoto, Utah, 1913–
    - Kingston canal at Kingston, Utah, 1914–

Sevier River tributaries—Continued.
  - Pine Creek at Marysvale, Utah, 1914.
  - Clear Creek at Sevier, Utah, 1912–
    - Cove canal at Sevier, Utah, 1914–
  - Monroe South Bend canal near Joseph, Utah, 1914–
  - Sevier Valley canal near Joseph, Utah, 1912–
  - Sevier Valley canal at Elsinore, Utah, 1913.
  - Sevier Valley canal near Richfield, Utah, 1912–
  - State canal near Vermilion, Utah, 1913.
  - State canal near Aurora, Utah, 1913.
  - State canal near Salina, Utah, 1913.
  - State canal near Redmond, Utah, 1913–
    - Joseph canal near Joseph, Utah, 1914–
  - Wells canal near Joseph, Utah, 1914–
  - Monroe canal near Elsinore, Utah, 1914–
  - Elsinore canal near Elsinore, Utah, 1914–
  - Brooklyn canal near Elsinore, Utah, 1914–
  - Richfield canal near Elsinore, Utah, 1914–
  - Annabella canal at Elsinore, Utah, 1914–
  - Vermilion canal near Richfield, Utah, 1914–
  - Rockyford canal near Vermilion, Utah, 1914–
  - Salina Creek at Salina, Utah, 1914–
  - West View canal at Redmond, Utah, 1914–
  - Fayette canal near Centerville, Utah, 1914–
  - Dover canal near Gunnison, Utah, 1914–
  - San Pitch River near Gunnison, Utah, 1900–1905; 1912–
    - Manti Creek near Manti, Utah, 1900.
  - Wellington canal near Mills, Utah, 1914–
  - Sevier River Land & Water Co.'s canal near Leamington, Utah, 1914–
  - Sevier River Land & Water Co.'s canal above Fool Creek reservoir, near Lynndyl, Utah, 1914.
    - Sevier River Land & Water Co.'s by-pass near Lynndyl, Utah, 1914.
  - Sevier River Land & Water Co.'s reservoir No. 1 (Fool Creek reservoir) near Lynndyl, Utah, 1914.
  - McIntyre canal near Leamington, Utah, 1914–
  - Leamington canal near Leamington, Utah, 1914–
  - Delta and Mellville canal (Canal A) near Delta, Utah, 1912–
    - Canal B at intake, near Delta, Utah, 1912.
      - Lyman's ditch near Delta, Utah, 1912.
    - Melville West Side canal near Delta, Utah, 1912.
    - Canal C at head gate near Delta, Utah, 1912.
  - Melville Main canal near Delta, 1912.
  - Midland canal near Delta, Utah, 1914.
  - Abraham canal near Delta, Utah, 1913; 1914.
  - Deseret High-Line canal near Delta, Utah, 1913; 1914.
  - Deseret canal near Delta, Utah, 1913; 1914.
    - Smith canal near Delta, Utah, 1914.

STREAMS IN PAVANT VALLEY.

Chalk Creek near Fillmore, Utah, 1914.
Pine Creek near Fillmore, Utah, 1914.
Meadow Creek near Meadow, Utah, 1914.
Corn Creek near Kanosh, Utah, 1914.

BEAVER RIVER BASIN.

- Beaver River near Beaver, Utah, 1906; 1914–
- Beaver River at Adamsville, Utah, 1913–
- Beaver River at Rockyford dam, near Minersville, Utah, 1913–
- Beaver River at Minersville, Utah, 1909–1913.
- Beaver River at Milford, Utah, 1914.
  - South Creek near Beaver, Utah, 1906.
  - North Fork of North Creek (head of North Creek) near Beaver, Utah, 1906.
    - South Fork of North Creek near Beaver, Utah, 1906.
  - Indian Creek at Adamsville, near Beaver, Utah, 1906; 1914–
  - Minersville canal at Minersville, Utah, 1906; 1914.
  - Coal Creek near Cedar City, Utah, 1915–

MINOR BASINS IN NEVADA.

- Thousand Springs Creek near Tecoma, Nev., 1910–1913.
- Snake Creek near Baker, Nev., 1913–15; 1916–17.
- Baker Creek near Baker, Nev., 1913–1915.
- Cleveland Creek near Osceola, Nev., 1914–1916.
- White River near Preston, Nev., 1914.
- Currant Creek at Ranger Station near Currant, Nev., 1913.
- Currant Creek at Cazier's Ranch near Currant, Nev., 1913; 1914–
- Big Warm Spring near Duckwater, Nev., 1915–16.
- Duckwater Creek near Duckwater, Nev., 1915–
- Lees Creek near Pahrump, Nev., 1916.
- Intermittent Springs near Pahrump, Nev., 1916.
- Birch Creek near Austin, Nev., 1913; 1914.

SALTON SINK BASIN.

- Salton Sea near Salton, Cal., 1904–
  - Alamo River near Brawley, Cal., 1909–1912.
  - New River near Brawley, Cal., 1909–1911.

OWENS LAKE BASIN.

- Owens River near Round Valley, Cal., 1903–
- Owens River near Big Pine [Tinemaha], Cal., 1906–
- Owens River near Lone Pine, Cal., 1909–
- Owens River near Citrus, Cal., 1903–1906.
- Owens Lake near Lone Pine (Olancha), Cal., 1908–
  - Rock Creek near Round Valley, Cal., 1903–
    - Pine Creek near Round Valley, Cal., 1903–
  - Owens River canal near Bishop, Cal., 1903–1905.
  - McNally canal near Bishop, Cal., 1903–1905.
  - Farmers canal near Bishop, Cal., 1903–1905.
  - Bishop Creek near Bishop, Cal., 1903–1911.
  - Hillside (North) canal near Bishop, Cal., 1903–1905.
  - Hillside (South) canal near Bishop, Cal., 1903–1905.
  - Powers canal near Bishop, Cal., 1903–1905.
  - Bishop Creek canal near Bishop, Cal., 1903–1905.
  - Collins (George) canal near Bishop, Cal., 1903–1906.
  - Collins (A. O.) canal near Bishop, Cal., 1903–1906.
  - Dell canal near Bishop, Cal., 1903–1906.
  - Big Pine and Owens River canal near Bishop, Cal., 1903–1905.

- Owens Lake—Continued.
  - Rawson canal near Bishop, Cal., 1903–1905.
  - Sanger canal near Alvord, Cal., 1903–1905.
  - Baker Creek near Big Pine, Cal., 1908–1911.
  - Big Pine Creek near Big Pine, Cal., 1903–1911.
  - Tinemaha Creek near Big Pine [Tinemaha], Cal., 1906–1911.
  - Birch Creek near Big Pine [Tinemaha], Cal., 1905; 1906–1911.
  - Taboose Creek near Aberdeen, Cal., 1906–1911.
  - Goodale Creek near Aberdeen, Cal., 1906–1911.
  - Division Creek near Independence, Cal., 1906–1910.
  - Eightmile (Sawmill) Creek near Independence, Cal., 1906–1910.
  - Thibaut Creek near Independence, Cal., 1908–1911.
  - East Side canal near Citrus, Cal., 1903–1906.
  - Stevens canal near Citrus, Cal., 1903–1905.
  - Oak Creek near Independence, Cal., 1905-1911:
  - Little Pine (Independence) Creek near Independence, Cal., 1905–1911.
  - Shepard Creek near Theve, Cal., 1906–1010.
  - Bairs Creek near Thebe, Cal., 1906–1911.
  - George Creek near Thebe, Cal., 1906–1911.
  - Lone Pine Creek near Lone Pine, Cal., 1906–1911.
    - Tuttle Creek near Lone Pine, Cal., 1906–1911.
  - Cottonwood Creek near Olancha, Cal., 1906–1911.
  - Ash Creek near Olancha, Cal., 1907–1911.

ANTELOPE VALLEY BASIN.

- Littlerock Creek near Palmdale, Cal., 1896–1898.

MOHAVE RIVER BASIN.

- Mohave River near Victorville, Cal., 1899–1906.

MONO LAKE BASIN.

- Mono Lake near Mono Lake, Cal., 1912–
  - Rush Creek near Mono Lake, Cal., 1910–1914.
  - Leevining Creek near Mono Lake, Cal., 1910–1916.

WALKER LAKE BASIN.

- East Walker River (head of Walker River), Bridgeport, Cal., 1911–1914.
- East Walker River near Yerington, Nev., 1902–1908.
- East Walker River near Mason, Nev., 1910–1912; 1913–
- Walker River near Nordyke, Nev., 1895.
- Walker River at Mason, Nev., 1910–1912; 1913–1916.
- Wakler River at Schurz, Nev., 1913–
- Walker River near Wabuska, Nev., 1902–1908.
  - Robinson Creek near Bridgeport, Cal., 1910–1914.
  - Buckeye Creek near Bridgeport, Cal., 1910–1914.
    - Swagger Creek near Bridgeport, Cal., 1911-1915.
  - West Walker River near Coleville, Cal., 1902–1908; 1909–1910; 1915–
  - West Walker River near Wellington, Nev., 1910.
  - West Walker River at Smith, Nev., 1910.
  - West Walker at Hudson, Nev., 1914–
    - East Fork ot West Walker River near Bridgeport, Cal., 1910.

HUMBOLDT-CARSON SINK.

- Carson River basin:
  - Carson River, East Fork (head of Carson River), at Silver King Valley, near Markleeville, Cal., 1910–1913.
- Carson River, East Fork, near Markleeville, Cal., 1910–
- Carson River, East Fork at Rodenbah's ranch, near Gardnerville, Nev., 1900–1906.
- Carson River, East Fork, at Horsehoe Bend, near Gardnerville, Nev., 1908–1910.
- Carson River, East Fork at California-Nevada State Line, 1911–1914.
- Carson River near Empire, Nev., 1895; 1900–
- Carson River near Fort Churchill, Nev., 1911–
- Carson River near Hazen, Nev., 1908–1910.
    - Silver Creek near Markleeville, Cal., 1910–1913.
    - Markleeville Creek above Markleeville, Cal., 1911–
    - Markleeville Creek at Markleeville, Cal., 1910–
      - Pleasant Valley Creek near Markleeville, Cal., 1910–1911.
    - West Fork of Carson River at Woodfords, Cal., 1890–1892; 1900–
- Humboldt River basin:
  - Humboldt River near Elko, Nev., 1895–1902.
  - Humboldt River at Palisade, Nev., 1902–1906; 1911–
  - Humboldt River at Battle Mountain, Nev.,1896–7.
  - Humboldt River near Golconda, Nev., 1894–1909; 1910–
  - Humboldt River near Oreana, Nev., 1896–1909; 1910–
  - Humboldt River near Lovelocks, Nev., 1912–
    - Bishop Creek near Wells, Nev., 1910.
    - Starr Creek near Deeth, Nev., 1913–
    - Marys River at Marys River Cabin, near Deeth, Nev., 1913–14.
    - Marys River at Buena Vista ranch, near Deeth, Nev., 1913–14.
    - Marys River near Deeth, Nev., 1902–3; 1912–
      - Hanks Creek near Deeth, Nev., 1913–14.
    - Lamoille Creek near Lamoille, Nev., 1915–
    - Lamoille Creek near Halleck, Nev., 1913–
    - North Fork of Humboldt River near Peko, Nev., 1898–1900.
    - North Fork of Humboldt River at Devils Gate, near Halleck, Nev., 1913–
    - North Fork of Humboldt River near Halleck, Nev., 1902-1909; 1910–1913.
    - South Fork of Humboldt River near Elko, Nev., 1896–1909; 1910–
    - Maggie Creek at Carlin, Nev., 1913–
    - Pine Creek at Palisade, Nev., 1902–1904; 1912–1914.
    - Rock Creek at Rock Creek ranch, near Battle Mountain, Nev., 1915–
    - Rock Creek near Battle Mountain, Nev., 1896.
    - Reese River near Berlin, Nev., 1913–
      - Big Creek near Austin, Nev., 1913–14; 1916–
    - Humboldt-Lovelocks Irrigation Light & Power Co.'s canal near Mill City, Nev., 1914–
    - Humboldt-Lovelocks Irrigation Light & Power Co.'s canal near Humboldt, Nev., 1914–

PYRAMID AND WINNEMUCCA LAKE BASINS.

- Lake Tahoe at Tahoe, Cal., 1900–
- Truckee River at Tahoe, Cal., 1895–96; 1900–
- Truckee River near Boca, Cal., 1890.
- Truckee River at Iceland, Cal., 1912–
- Truckee River at Nevada-California State line, 1899–1912.
- Truckee River at Laughton, Nev., 1890.

- Truckee River at Reno, Nev., 1906–
- Truckee River near Essex, Nev., 1889.
- Truckee River at Vista, Nev., 1899–1908.
- Truckee River at Clarks, Nev., 1907–1915.
- Truckee River at Derby dam, Nev., 1907–1910.
- Truckee River near Wadsworth, Nev., 1902–1905.
- Lake Winnemucca inlet near Wadsworth, Nev., 1902–1905.
    - Donner Creek at Donner Lake, near Truckee, Cal., 1909–10.
    - Donner Creek near Truckee, Cal., 1902–1914.
    - Prosser Creek near Hobart Mills (Truckee), Cal., 1903–4; 1907–1912.
    - Prosser Creek near Boca, Cal., 1899–90; 1902–3.
        - South Fork of Prosser Creek near Truckee, Cal., 1909–10.
    - Little Truckee River near Truckee, Cal., 1909–10.
    - Little Truckee River near Boca, Cal., 1890.
    - Little Truckee River at Boca, Cal., 1911–1914.
    - Little Truckee River at Pine Station and Starr, Cal., 1903–1910.
        - Webber Creek near Truckee, Cal., 1909–10.
        - Independence Creek below Independence Lake, Cal., 1902–1907.
        - Independence Creek near Truckee, Cal., 1909–10.
    - Steamboat Creek at Steamboat Springs, Nev., 1900–1901.
        - Galena Creek near Washoe, Nev., 1913–14.

HONEY LAKE BASIN.

- Susan River near Susanville, Cal., 1900–1905; 1913.
    - Gold Run Creek near Susanville, Cal., 1913; 1915–16.
    - Lassen Creek near Susanville, Cal., 1913; 1915–16.
    - Willow Creek at Merrillville, Cal., 1904–5.
    - Willow Creek near Standish, Cal., 1900–1901; 1905.
- Baxter Creek near Janesville, Cal., 1913–1916.
    - Schloss Creek at Janesville, Cal., 1915.
    - Janesville Creek at Janesville, Cal., 1913; 1915.

SURPRISE VALLEY DRAINAGE BASIN.

- Bidwell Creek near Fort Bidwell, Cal., 1912.

WARNER LAKES BASIN.

- Cowhead Lake near Fort Bidwell, Cal., 1911–1913.
- Twentymile Creek near Warner Lake, Oreg., 1910–1916.
    - Fifteenmile Creek above Twelvemile Creek, near Fort Bidwell, Cal., 1913.
    - Fifteenmile Creek below Rock Creek, near Fort Bidwell, Cal., 1913.
        - Twelvemile Creek near Fort Bidwell, Cal., 1912–13.
    - Rock Creek near Fort Bidwell, Cal., 1913.
- Deep Creek near Fort Bidwell, Cal., 1913.
- Deep Creek at Big Valley, near Lakeview, Oreg., 1911–1915.
- Deep Creek at Adel, Oreg., 1909–1916.
    - Dismal Creek near Fort Bidwell, Cal., 1913.
    - Camas Creek near Plush, Oreg., 1911–12.
    - Camas Creek below Blue Creek, near Lakeview, Oreg., 1912–1915.
        - Mud Creek near Plush, Oreg., 1911–12; 1915.
        - Crane Creek near Lakeview, Oreg., 1914.
        - Drake Creek near Adel, Oreg., 1915.
        - M. C.-Givan ditch near Adel, Oreg., 1915.
        - Company ditch near Adel, Oreg., 1915.
        - M. C. ditch at Adel, Oreg., 1915.

- Fish Creek near Plush, Oreg., 1914.
- Honey Creek at Chalstrand's ranch, near Plush, Oreg., 1910–11.
- Honey Creek near Plush, Oreg., 1909–1914; 1915.
    - Twelvemile Creek near Plush, Oreg., 1911.
    - Snyder Creek near Plush, Oreg., 1911.
- Pelican Lake near Adel, Oreg., 1913–1915.
- Crump Lake near Adel, Oreg., 1910–1912; 1913; 1914; 1915.
- Hart Lake near Plush, Oreg., 1910–1915.
- Flagstaff Lake inlet near Plush, Oreg., 1914.
- Flagstaff Lake near Plush, Oreg., 1910–1915.
- Lower Campbell Lake near Plush, Oreg., 1914; 1915.
- Stone Corral Lake near Plush, Oreg., 1914; 1915.
- Bluejoint Lake near Plush, Oreg., 1911–1915.

ABERT LAKE BASIN.

- Chewaucan River at dam site, near Paisley, Oreg., 1912–
- Chewaucan River above Mill Creek, near Paisley, Oreg., 1912–
- Chewaucan River at Chewacan Land & Cattle Co.'s gage, near Paisley, Oreg., 1914–
- Chewaucan River above Conn's ditch, near Paisley, Oreg., 1912.
- Chewaucan River at Paisley, Oreg., 1905–1907; 1909–1912; 1913.
- Chewaucan River at Narrows, near Paisley, Oreg., 1914–
- Chewaucan River at Hotchkiss Ford, near Paisley, Oreg., 1914.
    - Conn ditch near Paisley, Oreg., 1914–
    - Smalls Creek at Paisley, Oreg., 1914–
    - Bagley ditch at Paisley, Oreg., 1914–
    - Jones-Innis-ZX ditch near Paisley, Oreg., 1914–
    - Crooked Creek near Valley Falls, Oreg., 1912–13.

SUMMER LAKE BASIN.

- Ana River near Summer Lake, Oreg., 1905; 1909–10.

SILVER LAKE BASIN.

- Silver Creek near Silver Lake, Oreg., 1904–1907; 1909–
    - Bridge Creek near Silver Lake, Oreg., 1905–6; 1911–12.
- Buck Creek near Silver Lake, Oreg., 1905–6; 1909–1911.

MALHEUR AND HARNEY LAKES BASIN.

- Malheur Lake outlet at Narrows, Oreg., 1903–1906; 1911–12; 1913; 1914; 1916.
- Mud Lake outlet near Narrows, Oreg., 1916.
    - Silvies River near Silvies, Oreg., 1903–1905; 1909–1912; 1916–
    - Silvies River near Burns, Oreg., 1903–1906; 1909–1915; 1916–
    - West Fork of Silvies River near Lawen, Oreg., 1916.
    - East Fork of Silvies River near Lawen, Oreg., 1916.
    - Donner und Blitzen River near Diamond, Oreg., 1909–
    - Donner und Blitzen River near Narrows, Oreg., 1915; 1916.
    - Donner und Blitzen River near Voltage, Oreg., 1916–
        - Mud Creek near Diamond, Oreg., 1911–1916.
        - Bridge Creek near Diamond, Oreg., 1911; 1912–1916.
        - Krumbo Creek near Diamond, Oreg., 1911; 1913.
        - Keiger Creek near Diamond, Oreg., 1909–10; 1911; 1912–13; 1916–
            - Cucamonga Creek near Diamond, Oreg., 1911–1913; 1916.
            - McCoy Creek near Diamond, Oreg., 1909–1914; 1916–

Mud Lake outlet—Continued.
  Riddle Creek near Smith, Oreg., 1911.
  Buena Vista canal near Narrows, Oreg., 1915; 1916–
  Silver Creek above Riley, Oreg., 1904-1906; 1909; 1910; flood periods 1911–1915; 1916–
  Silver Creek below Riley, Oreg., 1912; 1913; 1914.

ALVORD LAKE BASIN.

Trout Creek near Denio, Oreg., 1911–12.
Little Cottonwood Creek near Denio, Oreg., 1911–12.

TUMTUM LAKE BASIN.

Van Horn Creek near Denio, Oreg., 1911.

CATLOW VALLEY, DRAINAGE BASIN.

Home Creek near Beckley (Narrows), Oreg., 1911; 1912; 1915–

REPORTS ON WATER RESOURCES OF THE GREAT BASIN.

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-Supply Papers are of octavo size.

*7. Seepage water of northern Utah, by Samuel Fortier. 1897. 50 pp., 3 pls. 10c.

Describes Cache Valley and its water supply and seepage waters in Ogden Valley.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes the location and construction of various types of canals for irrigation.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along Sevier, Bear, and Humboldt rivers; also brief descriptions.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 10c.

*61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

A second, revised, edition of Nos. 57 and 61 was published in 1905 as Water-Supply Paper 149 (q. v.).

68. Water storage in the Truckee Basin, California-Nevada, by L. H. Taylor. 1902. 90 pp., 8 pls. 10c.

Discusses reservoir sites, water rights for power and irrigation, irrigable lands, duty of water, and necessity for national control of water.

*78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River Plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the conditions on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to govern the use of artesian waters; gives list of publications bearing on artesian waters.

*81. California hydrography, by J. B. Lippincott. 1903. 488 pp., 1 pl. 25c.

A collection of published records of stream flow "hitherto much scattered, some of them out of print and difficult to secure," brought together as a book of reference.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 130 pp. Superseded by Water-Supply Paper 152.

Cites statutory restrictions of water pollution in California, Idaho, Nevada, Oregon, Utah and Wyoming.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts affecting ground waters in California, Idaho, Nevada, Oergon, Utah, and Wyoming.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses flow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

A brief report on "Hydrographic investigations in Nevada," by A. E. Chandler. Gives notes concerning fluctuations and average discharge at stations on Truckee, Humboldt, Carson, and Walker rivers.

A report on "Underground waters of southern California," by W. C. Mendenhall. Discusses the origin, distribution, and character of the artesian waters, the causes of fluctuations in the supply, and the need of moderation in use.

*149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in California, Idaho, Nevada, Oregon, Utah, and Wyoming.

*157. Underground water in the valleys of Utah Lake and Jordan River, Utah, by G. B. Richardson. 1906. 81 pp., 9 pls. 20c.

Discusses the source, distribution, recovery, and quality of waters; contains list of typical wells.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates of flood flow and frequency of Bear River at Collinston, Utah, and Humboldt River at Golconda, Nev. (p. 85).

*181. Geology and water resources of Owens Valley, Cal., by W. T. Lee. 1906, 28 pp., 6 pls. 15c.

Discusses artesian conditions, utilization of ground waters by pumping and power plants, and undrained lakes as registers of climate. See also Water-Supply Paper 294.

*199. Underground water in Sanpete and central Sevier valleys, Utah, by G. B. Richardson. 1907. 63 pp., 6 pls. 25c.

Describes topography and geology of the area, the sources, distribution, recovery, and quality of the ground waters; presents tabulated data concerning springs and wells.

*217. Water resources of Beaver Valley, Utah, by W. T. Lee. 1908. 57 pp., 1 pl. 10c.

Describes possible development of surface and ground waters, and quality of waters; contains field assays of well water, and sanitary and other exact analyses.

*220. Geology and water resources of a portion of south-central Oregon, by G. A. Waring. 1908. 86 pp., 10 pls. 20c.

Describes the rocks, streams, lakes and lake valleys, deep and shallow wells, climate, soils, vegetation, industries, and reclamation projects in Lake County; gives analyses of soils and waters.

*224. Some desert watering places in southeastern California and southwestern Nevada, by W. C. Mendenhall. 1909. 98 pp., 4 pls. 20c.

Describes physical features of the Colorado and Mohave deserts and the Death Valley region, mineral resources and industrial development, climate, rivers, springs, and camping places; gives hints on desert traveling; describes main routes of travel, and gives details concerning the springs.

*225. Ground waters of the Indio region, California, with a sketch of the Colorado Desert, by W. C. Mendenhall. 1909. 56 pp., 12 pls. 20c.

Describes the structural features and deposits of the Colorado Desert, rainfall, and drainage, the origin, source, character, and development of ground waters; gives history of development of the Indio region, and discusses soils, crops, and cost of reclamation.

*231. Geology and water resources of the Harney Basin region, Oregon, by G. A. Waring. 1909. 93 pp., 5 pls. 25c.

Describes topography, climate, vegetation, settlements and industries, the rocks and their succession, lakes, springs, and streams, and artesian conditions; discusses conservation of water supply, temperature of ground waters, and well-drilling methods; describes in detail Harney, Catlow, Alvord, and Whitehorse basins, and Malheur River basin.

237. The quality of the surface waters of California, by Walton Van Winkle and F. M. Eaton. 1910. 142 pp., 1 pl. 20c.

Describes geography, climate, industrial development, and drainage, and gives results of mineral analyses of the river waters.

274. Some stream waters of the Western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Carson, Truckee, and Owens rivers.

277. Ground water in Juab, Milliard, and Iron counties, Utah, by O. E. Meinzer. 1911. 162 pp., 5 pls. 25c.

Describes the physiographic features, geologic formations, and history, the rainfall, soil, vegetation, streams, and industrial development; discusses the occurrence of ground water in the bedrock and in unconsolidated sediments, artesian conditions and springs, the quality of the ground waters, irrigation, construction of wells, and watering places on routes of travel; describes in detail Juab Valley and Round, Little, Sage, Dog, and Fernow valleys, Tintic Valley and Tintic mining district, Pavant and Lower Beaver valleys, Old River Bed and Cherry Creek region, Drum and Swasey Wash region, Sevier Desert, Wah Wah Valley, Sevier Lake bottoms, White, Fish Springs, Snake, Parowan, and Rush Lake valleys, and Escalante Desert; analyses.

278. Water resources of Antelope Valley, Cal., by H. R. Johnson. 1911. 92 pp. 7 pls. 25c.

Describes topography, drainage, climate, physiography, and the water-bearing and non-water-bearing rocks of areas in Kern, Los Angeles, and San Bernardino counties; discusses the influence of rainfall on the surface and ground waters, the artesian water and nonartesian water, bedrock springs, chemical character (analyses, alkali, dissolved solids, hygienic conditions), fallacies as to origin and quantities of artesian water, and the present and future development of the underground supplies.

294. An intensive study of the water resources of a part of Owens Valley, Cal., by C. H. Lee. 1912. 135 pp., 30 pls. 55c.

Describes topography, drainage, and structure of the valley, and discusses precipitation, stream flow, evaporation, percolation, and ground waters; bibliography.

297. Gazetteer of surface waters of California, Pt. III: Pacific coast and Great Basin streams, by B. D. Wood. 1913. 244 pp. 20c.

Contains description of streams and lakes of the Great Basin in California.

*300. Water resources of California, Pt. III: Stream measurements in the Great Basin and Pacific coast river basins, by H. D. McGlashan and H. J. Dean. 1913. 956 pp., 4 pls. 55c.

Describes the general features of the Great Basin in California, the Great Basin lakes in California and Nevada and gives results of stream-flow investigations available up to September 30, 1912.

333. Ground water in Box Elder and Tooele counties, Utah, by Everett Carpenter. 1913. 90 pp., 2 pls. 10c.

338. Springs of California, by Gerald A. Waring. 1915. 410 pp., 13 pls. 60c.

Describes briefly the physical features of California, including the coast ranges, Great Central Valley, the lava-covered region, the Sierra Nevada, the southeastern desert, and faults; defines "mineral water" and "pure water"; discusses source and amount of substances in waters, degree of concentration of natural waters and their properties, and the therapeutic value, temperature, and classification of mineral waters. The springs are described under the headings "hot," "carbonated," "sulphur," "saline," "magnesic," "iron," "artesian," "large cold," and "minor perennial" springs.

350. Profile surveys in Bear River basin, Idaho, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 6 pls. 10c.

Contains a brief description of Bear River basin and a list of the gaging stations that have been maintained and mentions publications containing the results of measurements of stream flow in the basin. The maps show not only the outlines of the river banks, the islands, the positions of rapids, falls, shoals, and existing dams, and the crossings of all ferries and roads but the contours of banks to an elevation high enough to indicate the possibility of using the stream for the development of power by low or medium heads.

363. Quality of the surface waters of Oregon, by Walton Van Winkle. 1914. 137 pp., 2 pls. 20c.

Gives the results of an investigation made in cooperation with the State of Oregon "to determine the chemical composition of the waters of said State for a period of 14 months from" July 1, 1911. Describes the natural features of Oregon, discusses water for domestic and industrial uses, purification of water, and gives the results of analyses of waters of streams tributary to the Pacific and of a number of those discharging into the Great Basin; gives an outline of the geological history of the Great Basin, and brief descriptions of the general features of the Harney, Warner Lakes, Alkali Lake, Christmas Lake, and Chewaucan basins.

364. Water analyses from the laboratory of the United States Geological Survey tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters of rivers, lakes, wells, and springs in Utah, Nevada, California, and Oregon, and of mine waters from Tintic, Utah, and Tonopah and Kimberly, Nev.

365. Ground water in southeastern Nevada, by Everett Carpenter. 1915. 86 pp. 5 pls. 15c.

Describes an area in Clark, Lincoln, White Pine, and Nye counties drained in part by streams tributary to Colorado River and in part by streams discharging into the Great Basin. Discusses stream, lake, and wind topography, vegetation, crops, and industrial development, rainfall, occurrence of water in bedrock and unconsolidated sediments, source and permanence of artesian waters, and character and distribution of springs; also the quality of waters for domestic use and for irrigation, and gives analyses. Gives details of water supply by areas in Las Vegas and Virgin river basins and the Great Basin. Gives information in regard to watering places on routes of travel.

370. Surface water supply of Oregon, 1878–1910, by F. F. Henshaw and H. J. Dean. 1915. 829 pp., 1 pl. 45c.

Contains information pertaining to the surface waters of Oregon collected by the United States Geological Survey and cooperating parties from 1878 to September 30, 1910.

*375. Contributions to the hydrology of the United States, 1915; Nathan C. Grover, chief hydraulic engineer. 1916. 181 pp., 19 pls. 15c. Contains:

(*d*) Ground water in Big Smoky Valley, Nev., by O. E. Meinzer, pp. 85–116, pls. 6–7. Describes a typical Nevada desert valley—a plain hemmed in by mountain ranges and underlain by porous rock waste eroded from these ranges and saturated with water discharged from them. This valley was selected for investigation not because it afforded exceptional opportunity for the utilization of ground waters, but because it was considered more or less typical of the undeveloped valleys of the State. Preliminary report. See 423.

420. Profile surveys along Henrys Fork, Idaho, and Logan River and Blacksmith Fork, Utah, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 8 pp., 10 pls. 10c.

Contains a brief description of the general features of Logan River basin and a list of the gaging stations that have been maintained in the basin. The maps show not only the outlines of the river banks, the islands, the positions of rapids, falls, shoals, and existing dams, and the crossings of all ferries and roads, but the contours of banks to an elevation high enough to indicate the possibility of using the stream for the development of power by low or medium heads.

423. Geology and water resources of Big Smoky, Clayton, and Alkali Spring valleys, Nevada, by Oscar E. Meinzer. 1917. 167 pp., 15 pls. 30c.

Covers in detail the area described briefly in Water-Supply Paper 375 (*d*) and two small adjoining areas.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

(*d*) Ground water in Reese River basin and adjacent parts of Humboldt River basin, Nevada, by G. A. Waring.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Third Annual Report of the United States Geological Survey, 1881–82, J. W. Powell, Director. 1883. xviii, 564 pp., 67 pls. $2.35. Contains:

*Sketch of the geological history of Lake Lahontan, by I. C. Russell, pp. 189–235, pls. 18–23. Describes the physical features of the Great Basin.

*Fourth Annual Report of the United States Geological survey, 1882–83, J. W. Powell, Director. 1884. xxxii, 473 pp., 85 pls. $1.65. Contains:

*A geological reconnaissance in southern Oregon, by I. C. Russell, pp. 431–464, pls. 83–85. Describes the interior drainage of southern Oregon; discusses the area, extent, quality of waters and recent changes in the existing lakes.

*Eighth Annual Report of the United States Geological Survey, 1886–87, J W. Powell, Director. 1889. 2 parts. *Part I, xix, 474, viii pp., pls. 76. $1.50. Contains:

*The Quaternary history of Mono Valley, Cal., by I. C. Russell, pp. 261–394, pls. 16–44. Describes the physiographic features and drainage of the Mono Lake basin, the sources of water supply of the present lake,including streams and springs,and discusses the chemical composition of the water and the fluctuations in lake level.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp., 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rain fall and evaporations, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the survey in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statements of the Director to the House Committee on Irrigation and extracts from the constitutions of States relating to irrigation.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp. 93 pls. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, pls. 54–57. Describes reservoir sites in Carson River basin at Red Lake, Pleasant Valley, Mountain Bullion, Indian Pool, Heenan Lake, Silver King Valley, Wolf Creek, Dumonts Meadow, all in Alpine County, along Rush Creek, in Hulls Meadow on Little Truckee River, at Twin Valley on the North Fork of Prosser Creek, at Monument Peak, at Grass Lake, and at Hope Valley, in California, and on Truckee River, Nev.; for each reservoir sites gives the location, height of dam, are inclosed by contour, approximate contents of reservoir, position of irrigable lands and areas of segregated lands.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, xi, 486 pp., 77 pl. $1.85. Contains:

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351–427, pls. 147–182. Describes Donner Lake, Independence Lake, and Webber Lake reservoirs, also Truckee canal in the Truckee River system, and Long Valley and Hope Valley reservoirs in the Carson River basin, Nev.

Report upon the location and survey of reservior sites during the fiscal year ending June 30, 1892, by A. H. Thompson, pp. 451–478. Describes Bear Lake reservoir site (Utah-Idaho), Silver Lake, Twin Lakes, and Marys Lake sites, and sites on Sanpitch, Sevier, East Fork of Sevier Otter Creek, Panquitch Lake, and at Blue Spring, Utah.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, pls. 34–39. Describes general character of the public lands, the lands disposed of (railroad lands grant, and swamp lands, and private miscellaneous entries), land reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reserviors as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, pls. 47–102. Discusses proposed Rock Creek reservoir in Humboldt River, Nev.; gives tables of reservoir capacities and areas; describes proposed reservoir of Antelope Valley Water Co., California, and on Rock Creek, Humboldt River basin, Nev.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts, II. III, IV, V, and VII, 1900.) 7 parts in 8 vols., and separate case for maps with Pt. V. *Pt. V, Forest Reserves, xix, 498 pp., 159 pls., 8 maps in separate case. $2.80. Contains:

*The San Gabriel Forest Reserve, by J. B. Leiberg, pp. 411–428, pls. 143–146.
*The San Bernardino Forest Reserve, by J. B. Leiberg, pp. 429–454, pls. 147–153.
The San Jacinto Forest Reserve, by J. B. Leiberg, pp. 455–478, pls. 154–159.

Describes general topographic features of forest reserves and drainage, part of which is by streams tributary to the Pacific, and part by streams that are lost in the sands of the Mohave and other deserts.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free but may be obtained from the Geological Survey at the prices indicated. An asterisk (*) indicates that the Survey's stock of paper is exhausted.

I. Lake Bonneville, by G. K. Gilbert. 1890. xx, 438 pp., 51 pls., 1 map. $1.50.

Contains in the introduction a description of the Great Basin; describes the present lakes and their oscillations, and gives analyses of the waters of Great Salt Lake and of fresh waters in the Salt Lake Basin.

XI. Geological history of Lake Lahonton, a Quaternary lake of northwestern Nevada, by I. C. Russell. 1885. xiv, 288 pp., 46 pls. $1.75.

Contains descriptions of the present rivers and lakes; discusses the chemical deposits of the area and gives analysis showing the composition of the principal rivers and lakes of the Lahontan Basin.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

95. Shorter contributions to general geology, 1915; David White, chief geologist. 1916. 120 pp., 7 pls. 20c.

Issued also in separate chapters. The following paper relates in part to ground water:

*(a) The composition of muds from Columbus Marsh, Nev., by W. B. Hicks (pp. 1–11). Gives data in regard to shallow wells on Columbus Marsh.

BULLETINS.

An asterisk (*) indicates tha the Geological Survey's stock of paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, Washington, D. C. Bulletins are of octavo size.

252. Preliminary report on the geology and water resources of central Oregon, by I. C. Russell 1905. 138 pp., 24 pls. 15c.

Describes a portion of the extreme northern part of the Great Basin and a part of the drainage area of Deschutes River and its principal tributary, Crooked River; gives an account of the topography, drainage, rainfall, and temperature, winds, and forests; describes the volcanic and sedimentary rock formations, and discusses, by counties, the geology and topography, the surface and underground waters; treats of artesian conditions in the Deschutes basin and makes suggestions concerning artesian well records.

*264. Record of deep well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veach. 1895. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated records of wells in Utah.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated: records of wells in California, Idaho, Nevada, Oregon, and Utah; and detailed record of well at Salt Lake City, Utah. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

*540. Contributions to economic geology, 1912, Part I, Metals and nonmetals except fuel; David White, chief geologist. 1914. 563 pp., 11 pls. 45c.

Issued also in separate chapters. The following papers contain information on ground water.

***(*n*) Prospecting for potash in Death Valley, Cal., by H. S. Gale (pp. 407–415). Included detailed sections of five wells, 30 to 70 feet deep, with data in regard to their waters, practically all of which are salty, as is shown by the analyses given.**

Potash tests at Columbus,Marsh, Nev., by H. S. Gale (pp. 422–427). Includes detailed sections of two wells, 32 and 82 feet deep, respectively, with data in regard to their waters, some of which are not salty.

***(*p*) Potash in western saline deposits, by J. H. Hance (pp. 457–469). Gives total solids in waters from various wells and springs in the drainage basins of Railroad Valley, Fourmile Flat and Dixie Salt Marsh, in Nevada, and the record of a 305-foot well at Adamana, Ariz.**

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped. The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sell for 25 cents a copy, except that some folios which contain an unusually large amount of matter, sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in higher-priced folios) are ordered at one time a discount of 40 per cent is allowed: $5.10 is the minimum amount accepted at this rate.

All folios contain descriptions of the drainage of the quadrangles.

*39. Truckee folio, California.

Describes the general and economic geology of an area extending westward and northward from Truckee Lake, drained by streams a part of which flow through Yuba and American rivers to the Sacramento, and part through Lake Tahoe to the Great Basin, discusses the topography and geology, and under "Economic geology" the mineral springs which occur abundantly throughout the area.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the Great Basin are the reports of the Reclamation Board, the State engineer and surveyor, the State Conservation Commission of California, the reports of the State engineers of Idaho, Oregon, Utah, and Wyoming, the biennial reports of the Bureau of Industry, Agriculture, and Irrigation of Nevada, and the annual reports of the United States Reclamation Service.

The following reports deserve special mention:

Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and national water laws, with detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Messrs. Clarence T. Johnston and L. J. Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bureau of Industry, Agriculture, and Irrigation Bull. 8, 1913.

Report of irrigation investigations in Utah, under the direction of Elwood Mead: U. S. Dept. Agr. Office Exper. Sta. Bull. 124, 1903.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the appropriation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by D. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines, also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. 10c. (See Water-Paper 22.)

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans.; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, compares wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp. (73–147), 2 pls. (15–16). 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. See also Nos. 64, 94, and 95.

*64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flows, and recovery of water by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage-pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this report should be addressed to the U. S. Reclamation Service.]

Contains the following papers of more or less general interest:
Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States., 1904 M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground water," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments of steel-concrete pipes on a working scale, by J. H. Quinton, 1905. 61 pp., 4 pls. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the U. S. Reclamation Service.]

Contains brief account of the organization of the hydrographic [water resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest.

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

*150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

*152. A review of the laws forbidding pollution of inland waters in the United States. second edition, by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuations due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, * * * with a history of the sewage-disposal problem, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and of resulting litigation discusses effect of acid-iron liquors on sewage purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of: amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 3639 pp., 2 pls.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of ground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties, contamination of well waters and methods of prevention, tests of capacity and measurement of depth, and costs of sinking wells.

*258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by title) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of water-works systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

334. The Ohio Valley flood of March-April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

*(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65. Scope indicated by title.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clake, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot Springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado, and Utah. Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing water-stage recorders and other gages and of constructing gage wells, shelters, structures for making discharge measurements, and artificial controls.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c.

Contains three papers presented at the conference of engineers of the water-resources branch in December, 1914, as follows:

*(c) Relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77-84.

(e) A method for correcting river discharge for a changing stage, by B. E. Jones, pp. 117-130.

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131-139.

*400. Contributions to the hydrology of the United States, 1916; N. C. Grover, chief hydraulic engineer. 1917. 108 pp., 7 pls. Contains:

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1-8.

*(c) The measurement of silt-laden streams, by R. C. Pierce, pp. 39-51.

(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

416. The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continually being received from all parts of the country" as to the efficacy of the divining rod for locating underground water.

425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

*(c) Hydraulic conversion tables and convenient equivalents, pp. 71-94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883-84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125 to 173, pl. 21. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, H. M. Wilson, pp. 363-561, pls. 107 to 146. See Water-Supply Paper 87.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–340, pls. 111–145.

Discusses the economic aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; describes perennial canals in Idaho, California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W. J. McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F H. King, pp. 59–294, pls. 6–16. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate, and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

A highly technical report.

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses.

*319. Summary of the controlling factors of artesian flows, by M. L. Fuller. 1908, 44pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water, and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the waters of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

616. The data of geochemistry (third edition), by F. W. Clarke. 1916. 821 pp. 45c.

Earlier editions were published as Bulletins 330 and 491. Contains a discussion of the statement and interpretation of water analyses and a chapter on "Mineral wells and springs" (pp. 179-216). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water analyses.

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[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many chemical analyses are scattered through the reports, as indicated by abstracts.

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1915

ACIFIC DRAINAGE BASINS

R AND PACIFIC DRAINAGE BASINS
OREGON

ER, Chief Hydraulic Engineer
. L. PARKER, District Engineers

peration with the States of
AND WASHINGTON

HINGTON
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1918

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' OF LOWER COLUMBIA RIVER .GE BASIN IN OREGON, 1915.

AND SCOPE OF WORK.

ries of 14 reports presenting results of ›n streams in the United States during), 1915.

›e reports were collected by the United ler the following authority contained in p. 394):

>)irector] shall have the direction of the Geological blic lands and examination of the geological struc- cts of the national domain.

1888 in connection with special studies › arid west. Since the fiscal year ending sundry bills passed by Congress have and appropriations:

> ermining the water supply of the United States, and und currents and artesian wells, and for the prepara- thods of utilizing the water resources.

for the fiscal years ending June 30, 1895–1916.

.... $12,500
.... 20,000
.... 50,000
.... 100,000
.... 200,000
.... 150,000
.... 100,000
.... 150,000

ıe work many private and State organizations by furnishing data or by assisting in collecting ts for cooperation of the first kind are made description of each station affected; coopera- l is acknowledged on page 14.

eam flow have been made at about 3,800 points and also at many points in Alaska and the ı July, 1915, 1,350 gaging stations were being rvey and the cooperating organizations. Many ge measurements are made at other points. In

connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miners' inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth of inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross-section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 9).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

An "acre-foot," equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

"Stage-discharge relation," an abbreviation for the term "relation of gage height to discharge."

"Control," "controlling section," and "point of control"; terms used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

EQUIVALENTS.

ient equivalents for use in hydraulic

t per square mile into run-off in depth in inches the area.

n-off (depth in inches).			
ys.	29 days.	30 days.	31 days.
041	1.079	1.116	1.153
083	2.157	2.231	2.306
124	3.236	3.347	3.459
165	4.314	4.463	4.612
207	5.393	5.578	5.764
.248	6.471	6.694	6.917
.289	7.550	7.810	8.070
.331	8.628	8.926	9.223
.372	9.707	10.041	10.376

ly the run-off for one day by the number of days.

e in second-feet into run-off in acre-feet.

Run-off (acre-feet).			
8 days.	29 days.	30 days.	31 days.
55.54	57.52	59.50	61.49
111.1	115.0	119.0	123.0
166.6	172.6	178.5	184.5
222.1	230.1	238.0	246.0
277.7	287.6	297.5	307.4
333.2	345.1	357.0	368.9
388.8	402.6	416.5	430.4
444.3	460.2	476.0	491.9
499.8	517.7	535.5	553.4

ultiply the run-off for one day by the number of days.

in second-feet into run-off in millions of cubic feet.

	Run-off (millions of cubic feet).			
	28 days.	29 days.	30 days.	31 days.
	2.419	2.506	2.592	2.678
	4.838	5.012	5.184	5.356
	7.257	7.518	7.776	8.034
	9.676	10.02	10.37	10.71
	12.10	12.53	12.96	13.39
	14.51	15.04	15.55	16.07
	16.93	17.54	18.14	18.75
2	19.35	20.05	20.74	21.42
6	21.77	22.55	23.33	24.10

h multiply the run-off for one day by the number of days.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter by the general methods outlined in standard textbooks on the measurement of river discharge. (See Pls. I, II.)

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

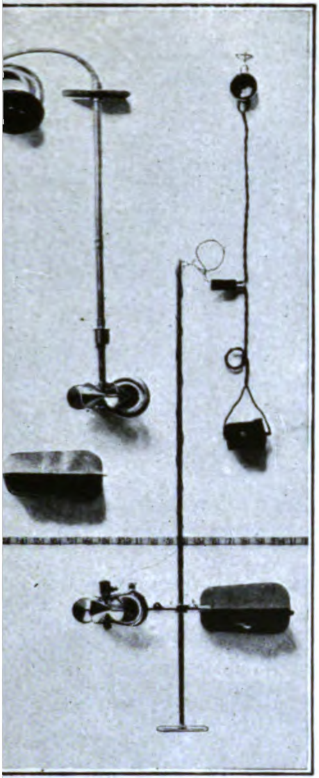
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

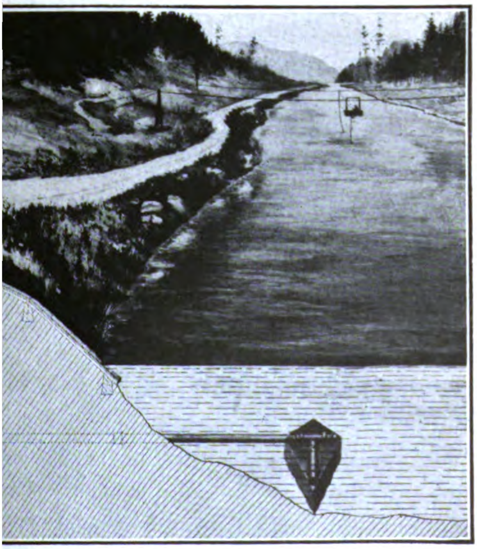
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of channel, and the cause and effect of backwater; it gives also information as to diversions that decrease the flow at the gage, artificial regulation, maximum and minimum recorded stages, and the accuracy of the records.

The table of daily discharge in general gives the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by use of the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

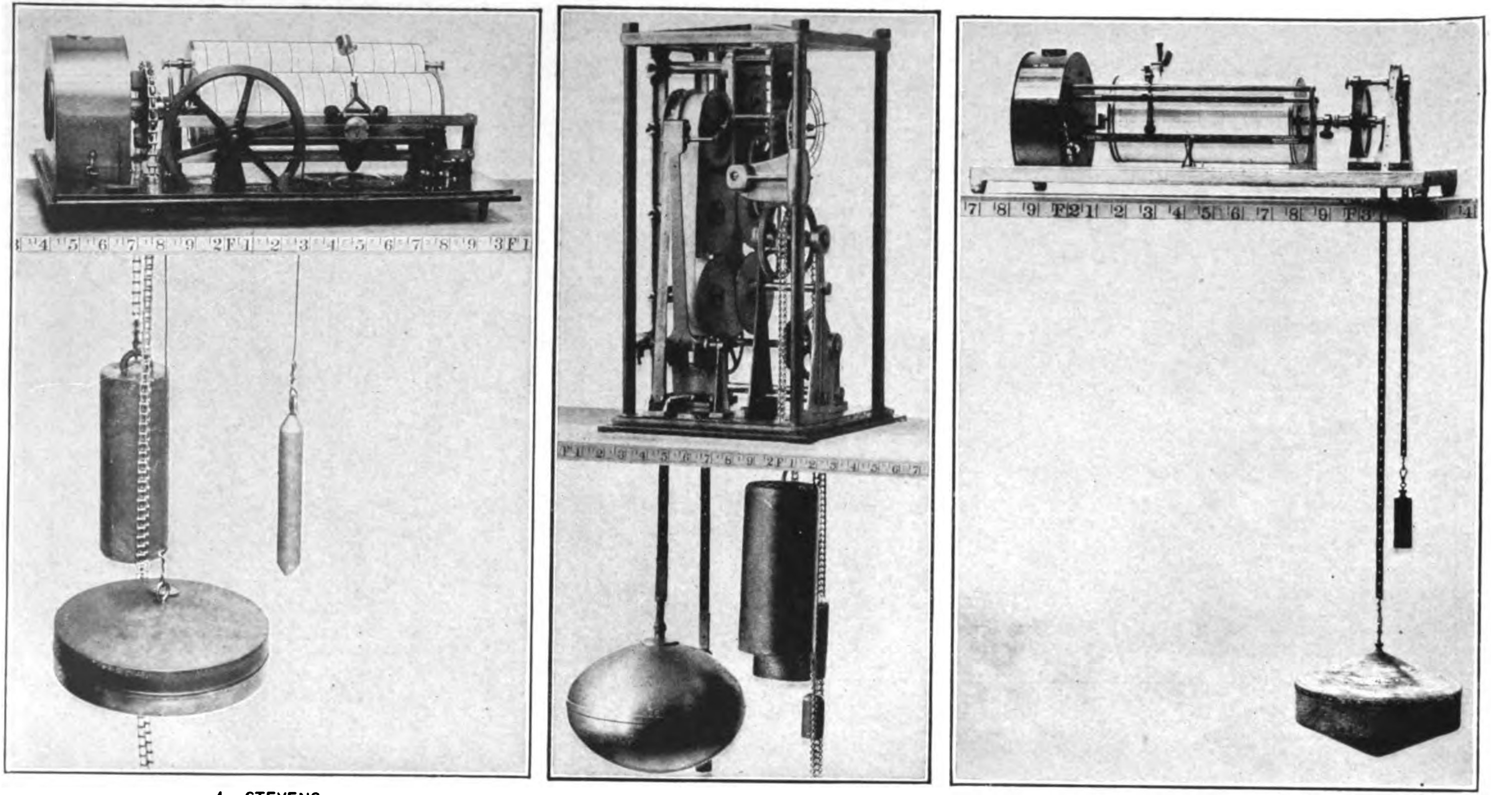
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



E CURRENT METERS.



TYPICAL GAGING STATION.



A. STEVENS. *B.* GURLEY PRINTING. *C.* FRIEZ.

WATER-STAGE RECORDERS.

The column headed "Mean" is the
ch second during the month. On
ecorded in the remaining columns,
based.

A AND COMPUTED RESULTS.

data depends primarily (1) on the
lation, and (2) on the accuracy of
ents of flow, and interpretation of

y discharge tables give information
y of the rating tables used, and an
the monthly discharge table. For
indicates, in general, that the rating
er cent; "fairly well defined," within
within 15 to 25 per cent. These notes
ed on the plotting of the individual
o the mean rating curve.
ded "Accuracy," in the table showing
ccuracy of the monthly mean and not
um or minimum discharge or the dis-
e rating is determined by considering
curve, the probable reliability of the
e readings per day, the range of the
l conditions. In this column, A indi-
flow is probably accurate within 5 per
C, within 15 per cent; D, within 25 per
covered by footnotes.
y station may represent with high accu-
flowing past the gage, but the figures
re mile and depth of run-off in inches
rs caused by the inclusion of large non-
e measured drainage area, by lack of
er diverted for irrigation or other use,
the effect of artificial regulation of the
station. "Second-feet per square mile"
hes)" are therefore not computed if such
The computations are also omitted for
g areas in which the annual rainfall is less
es representing "second-feet per square
in inches)" previously published by the
ith caution because of possible inherent
to the Survey.
lischarge gives only a general idea of the
uld not be used for other than preliminary

Channel and control.—Rocky and permanent at the rapids at Cascade Locks, the control for all three gages.

Extremes of discharge.—Maximum stage recorded during year, 20.8 feet at 8 a. m. June 1 (discharge, 328,000 second-feet); minimum stage recorded, −1.0 foot at 8 a. m. January 28 (discharge, 56,800 second-feet).

1857–1915: Maximum stage recorded, 59.6 feet June 6, 1894 (discharge, 1,170,000 second-feet); minimum stage recorded, —3.9 feet on gage at Cascade Locks January 7, 1890 (discharge, 41,900 second-feet).

Winter flow.—Stage-discharge relation possibly affected by ice for short periods in December and January.

Diversions.—Quantity of water diverted for irrigation is large in the aggregate but constitutes only a small proportion of the total flow; the low-water flow, which comes in the winter, is little affected.

Regulation.—None.

Accuracy.—Results considered good.

Cooperation.—Gage readings furnished by United States Weather Bureau.

No discharge measurements during year.

Daily discharge, in second-feet, of Columbia River at The Dalles, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	99,000	105,000	114,000	80,200	65,500	75,400	123,000	197,000	328,000	229,000	199,000	164,000
2	100,000	107,000	114,000	79,400	66,900	74,600	129,000	199,000	323,000	229,000	198,000	161,000
3	100,000	108,000	113,000	78,600	70,600	73,800	135,000	204,000	323,000	233,000	197,000	157,000
4	98,000	112,000	111,000	77,800	74,600	73,800	138,000	205,000	320,000	233,000	198,000	155,000
5	99,000	112,000	108,000	76,200	82,000	74,600	146,000	205,000	313,000	232,000	199,000	154,000
6	100,000	120,000	106,000	74,600	75,400	73,800	161,000	202,000	303,000	230,000	198,000	152,000
7	100,000	123,000	104,000	73,800	72,200	73,800	166,000	201,000	299,000	229,000	198,000	151,000
8	101,000	121,000	107,000	74,600	71,400	73,800	163,000	201,000	294,000	229,000	198,000	148,000
9	104,000	123,000	107,000	74,600	72,200	73,000	161,000	201,000	289,000	230,000	198,000	146,000
10	104,000	123,000	104,000	74,600	71,400	72,200	157,000	202,000	279,000	232,000	197,000	140,000
11	103,000	123,000	101,000	74,600	69,000	70,600	154.000	206,000	275,000	234,000	197,000	135,000
12	102,000	123,000	96,000	73,800	68,300	69,800	151,000	215,000	275,000	234,000	195,000	134,000
13	101,000	125,000	90,100	73,000	70,600	69,800	151,000	227,000	273,000	236,000	194,000	130,000
14	101,000	129,000	89,200	77,000	69,000	71,400	151,000	230,000	270,000	239,000	192,000	128,000
15	102,000	132,000	87,400	77,000	68,300	73,800	151,000	236,000	267,000	237,000	191,000	125,000
16	102,000	135,000	84,700	73,000	67,600	74,600	161,000	245,000	264,000	236,000	188,000	123,000
17	103,000	132,000	82,000	71,400	66,900	74,600	165,000	252,000	257,000	234,000	185,000	118,000
18	103,000	128,000	78,600	69,000	66,900	81,100	168,000	257,000	248,000	229,000	181,000	113,000
19	104,000	125,000	77,000	67,600	66,900	85,600	170,000	258,000	243,000	223,000	180,000	108,000
20	105,000	123,000	72,200	66,900	66,200	85,600	180,000	267,000	240,000	220,000	177,000	104,000
21	106,000	124,000	69,000	65,500	67,600	86,500	184,000	311,000	236,000	225,000	177,000	103,000
22	106,000	125,000	64,800	65,500	69,800	90,100	192,000	318,000	236,000	219,000	177,000	101,000
23	111,000	124,000	63,400	64,800	73,000	91,000	201,000	313,000	236,000	216,000	174,000	99,000
24	112,000	122,000	62,000	64,100	73,800	94,000	204,000	311,000	232,000	213,000	177,000	96,000
25	111,000	118,000	70,600	62,700	77,800	96,000	198,000	311,000	230,000	212,000	176,000	91,000
26	110,000	116,000	77,800	60,600	76,200	100,000	194,000	307,000	227,000	209,000	173,000	89,200
27	110,000	116,000	85,600	60,600	75,400	106,000	191,000	310,000	225,000	206,000	170,000	87,400
28	110,000	115,000	92,000	56,800	75,400	110,000	190,000	308,000	223,000	202,000	169,000	85,600
29	108,000	115,000	87,400	59,200	....	110,000	190,000	308,000	220,000	199,000	166,000	83,800
30	108,000	114,000	78,600	64,800	....	112,000	192,000	308,000	227,000	199,000	165,000	82,000
31	107,000	....	78,600	66,900	....	117,000	....	325,000	....	201,000	165,000	....

Note.—Discharge determined from rating curve well defined above 80,000 second-feet. Stage-discharge relation affected by ice at times in December and January, but open-water rating curve was used throughout year. Accuracy of determinations for December and January reduced.

he Dalles, Oreg., for the year ending Sept. 30, 915.

37,000 square miles]

n second-feet.			Run-off.		
m.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
000	104,000	0.439	0.51	6,400,000	A.
000	121,000	.511	.57	7,200,000	A.
000	89,500	.378	.44	5,500,000	B.
800	70,300	.297	.34	4,320,000	B.
500	71,100	.300	.31	3,950,000	A.
800	84,100	.355	.41	5,170,000	A.
000	167,000	.705	.79	9,940,000	A.
,000	253,000	1.07	1.23	15,600,000	A.
,000	266,000	1.12	1.25	15,800,000	A.
,000	224,000	.945	1.09	13,800,000	A.
,000	185,000	.781	.90	11,400,000	A.
,000	122,000	.515	.57	7,260,000	A.
,800	147,000	.620	8.41	106,000,000	

RIVER BELOW MOUTH OF SNAKE RIVER.

LLA RIVER BASIN.

VALLA RIVER NEAR MILTON, OREG.

N., R. 37 E., one-fourth mile above headgate of t Co. and about 12 miles above Milton, Umatilla

eptember 15, 1906; January 1, 1907, to March 14, mber 30, 1915. At point 6 miles below present 29, 1906.

foot above that used up to September 30, 1914.

by wading near gage.

d small boulders; practically permanent.

m stage recorded during year, 4.05 feet at 9 a. m. et); minimum stage recorded, 2.40 feet August 28 r 19 to 30 (discharge, 90 second-feet).

corded, 4.5 feet March 2 and 20, 1910, and January d-feet). A discharge of 1,650 second-feet was iles below, April 14, 1904, but the flow during the greater. Minimum discharge, 1903–1905, is that feet).

lation not affected by ice.

versions for irrigation.

xcellent.

Discharge measurements of South Fork of Walla Walla River near Milton, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 17	C. G. Paulsen	2.60	114
Aug. 16	C. E. Stricklin	2.42	98

Daily discharge, in second-feet, of South Fork of Walla Walla River near Milton, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	108	117	117	112	230	140	290	183	188	105	98	90
2	114	112	117	112	230	136	290	183	186	105	98	92
3	122	114	117	112	215	136	475	183	173	105	98	90
4	114	117	117	112	193	140	395	186	161	105	98	90
5	111	114	117	112	168	149	340	193	158	105	98	90
6	108	114	117	112	152	140	305	188	158	105	98	90
7	108	112	117	108	145	140	260	188	152	106	98	90
8	108	112	114	112	152	140	260	183	149	106	96	93
9	108	112	112	112	166	142	245	183	140	106	93	93
10	111	112	112	112	168	142	230	188	138	105	93	90
11	117	130	112	112	161	142	245	199	142	105	93	93
12	116	193	108	112	163	149	245	202	140	102	93	99
13	111	188	108	112	154	152	275	230	136	102	93	99
14	111	168	108	118	145	158	245	290	130	102	93	93
15	108	158	108	118	140	230	230	275	124	102	93	93
16	108	149	108	117	140	230	215	260	120	104	93	93
17	116	138	108	112	136	210	215	260	120	104	93	93
18	120	130	108	112	152	212	215	415	120	102	93	93
19	149	128	108	112	163	202	230	575	117	102	93	90
20	136	130	108	112	161	193	230	435	117	99	93	90
21	122	124	108	112	163	191	215	322	117	98	93	90
22	120	128	108	112	161	202	202	275	117	98	93	90
23	118	124	108	108	158	245	202	245	114	98	93	90
24	117	124	108	108	152	245	193	230	112	98	93	90
25	114	120	108	108	152	230	188	210	118	98	93	90
26	112	120	111	108	145	191	188	202	117	98	93	90
27	112	120	112	108	140	183	188	188	112	98	92	90
28	112	120	112	108	140	199	188	245	111	98	90	90
29	111	120	112	108	....	275	191	215	108	99	90	90
30	117	118	112	112	....	290	188	210	108	99	90	90
31	124	....	112	112	....	305	....	202	....	98	90	....

NOTE.—Discharge determined from a rating curve well defined between 90 and 400 second-feet.

Monthly discharge of South Fork of Walla Walla River near Milton, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	149	108	116	7,130	A.
November	193	112	129	7,680	A.
December	117	108	111	6,820	A.
January	118	108	112	6,890	A.
February	230	136	162	9,000	A.
March	305	136	188	11,600	A.
April	475	188	246	14,600	A.
May	575	183	243	14,900	A.
June	188	108	133	7,910	A.
July	106	98	102	6,270	A.
August	98	90	93.8	5,770	A.
September	99	90	91.5	5,440	A.
The year	575	90	144	104,000	

R WALLA WALLA, WASH.

. Willamette meridian, below the Walla Walla
s east of Walla Walla, in Walla Walla County.

3, to September 30, 1915.
cal staff on left bank, 0.5 to 7.0 feet, spiked
a cottonwood tree 500 feet below the diver-
works. A temporary gage at the same location
er 22, 1913. Gage read to quarter-tenths twice
dworks attendant for the Walla Walla water-

y wading.
not subject to overflow. Control consists of a
ich shifts at high stages. Zero flow would occur

m stage recorded during year, 2.60 feet May
inimum stage recorded, 0.69 foot at 6.30 p. m.
arge, 21 second-feet).
corded, 2.60 feet, February 27, 1914 (discharge,
e recorded, August 29 to September 1, 1915.
tion seriously affected by ice, flow estimated
atic records.
lla diverts 22 to 28 second-feet above the gage
surement of this diversion see page 174.
water-supply conduit are closed at infrequent
asins.
ned between 20 and 350 second-feet. Results
scharge relation was affected by ice.
furnished by city of Walla Walla.

near Walla Walla, Wash., during the year ending Sept. 30, 1915.

de by C. O. Brown.]

Dis- harge.	Date.	Gage height.	Dis- charge.
Sec.-ft.		*Feet.*	*Sec.-ft.*
33.7	May 18	2.19	299
a 108	Sept. 26	.72	23.5

ply diverting 21.6 second-feet past the gage.

Daily discharge, in second-feet, of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	43	37	38	34	134	63	269	66	102	32	27	22
2	41	35	38	37	182	61	238	69	91	32	26	23
3	41	35	38	37	209	66	334	74	77	31	26	23
4	37	35	37	43	146	77	301	87	70	31	26	23
5	35	38	37	41	102	76	254	92	63	31	24	23
6	35	38	36	41	87	76	196	87	59	31	25	23
7	34	37	35	40	87	74	182	84	66	32	26	23
8	34	37	35	40	107	73	146	79	74	33	24	24
9	34	36	35	45	146	71	121	77	59	32	24	23
10	37	35	34	43	134	69	113	91	50	31	24	24
11	37	61	34	42	109	67	105	117	48	31	24	23
12	41	102	32	45	91	66	107	121	48	29	24	29
13	41	134	32	44	80	70	130	134	45	29	24	31
14	39	91	32	51	66	77	109	196	44	30	27	26
15	37	73	32	52	61	209	100	209	43	30	27	25
16	35	61	32	47	61	196	94	182	41	32	27	24
17	38	56	32	45	63	157	94	182	40	37	25	24
18	37	50	31	41	79	182	94	269	40	30	24	24
19	52	48	31	41	113	157	92	440	38	29	24	24
20	44	47	30	40	111	134	87	351	37	29	24	24
21	40	45	30	40	111	121	84	254	37	28	24	24
22	39	44	31	38	105	132	77	182	35	27	23	24
23	38	42	31	38	86	157	77	146	34	27	23	24
24	37	42	32	38	77	146	71	146	34	27	24	24
25	36	41	32	37	80	121	69	121	41	27	23	24
26	36	41	34	37	74	102	69	111	36	27	23	24
27	35	42	33	36	69	87	67	102	34	27	23	24
28	35	41	41	35	66	84	64	157	34	27	23	24
29	37	40	37	35	....	238	74	134	32	29	23	24
30	38	39	34	34	....	334	77	128	32	28	22	23
31	35	....	32	40	....	301	....	109	....	28	22	....

NOTE.—Discharge ascertained from rating curve well defined between 20 and 350 second-feet. Discharge estimated, because of ice, from observer's notes and climatic records, Dec. 17–24.

Monthly discharge of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	52	34	38.0	2,340	A.
November	134	35	50.1	2,980	A.
December	41	....	33.8	2,080	B.
January	52	34	40.5	2,490	A.
February	209	61	101	5,610	A.
March	334	61	124	7,620	A.
April	334	64	130	7,740	A.
May	440	66	148	9,100	A.
June	102	32	49.5	2,950	A.
July	37	27	29.8	1,830	A.
August	27	22	24.4	1,500	A.
September	31	22	24.1	1,430	A.
The year	440	22	65.9	47,700	

. RIVER BASIN.

SH RESERVOIR, NEAR YOAKUM, OREG.

ırnish reservoir, about 5 miles above gaging
enter between.

ust 28, 1915.

y wading.
3yers mill race at Pendleton, and drawn down
water.
for days on which gage was read: each gage
1 readings, made over a considerable period to
ion.
r L. A. Reineman, water master for Umatilla

*ver above Furnish reservoir, near Yoakum, Oreg.,
r ending Sept. 30, 1915.*

Dis- ıarge.	Date.	Made by—	Gage height.	Dis-charge.
ec.-ft.			*Feet.*	*Sec.-ft.*
81	July 27	L. A. Reineman........	2.44	33
64	Aug. 28	W. P. Ward...........	2.32	24
46				

*ıtilla River above Furnish reservoir, near Yoakum,
year ending Sept. 30, 1915.*

.	June.	July.	Aug.	Day.	June.	July.	Aug.
				21		51	
				22	127		
		62	28	23			
				24	117	44	
		62		25			
				26	117		
				27		41	
	164			28			24
		60		29	107		
				30	82	41	
				31			

ıd 29 obtained by current-meter measurements unreferred to
ned from a well-defined rating curve.

*er above Furnish reservoir, near Yoakum, Oreg. for
r ending Sept. 30, 1915.*

	Discharge in second-feet.			Run-off (total in acre-feet).	Accu-racy.
	Maximum.	Minimum.	Mean.		
....	164	82	124	3,200	B.
....	81	41	59.2	3,640	B.
....	40	31	35.8	355	B.

by interpolating between days for which discharge is given.

UMATILLA RIVER AT YOAKUM, OREG.

Location.—In the SW. ¼ sec. 2, T. 2 N., R. 30 E., at the Yoakum wagon bridge, half a mile east of the Yoakum station of the Oregon-Washington Railroad & Navigation Co. and 18 miles below Pendleton, Umatilla County.

Drainage area.—1,200 square miles.

Records available.—May 5, 1903, to September 30, 1915.

Gage.—Vertical staff spiked to right abutment of highway bridge.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Rock and gravel; shifts in extreme floods. One channel at all stages. Left bank is overflowed during extreme floods. Control composed of lava boulders.

Extremes of discharge.—Maximum stage recorded during year, 7.90 feet at 9.30 p. m. April 2 (discharge, 4,240 second-feet); minimum stage recorded, 2.60 feet August 24 (discharge, 16 second-feet).

1903–1915: Maximum stage (from high-water marks), about 15.0 feet May 31, 1906 (discharge estimated as 23,900 second-feet); minimum stage, 2.45 feet August 10 to 12, 1908 (discharge, 12 second-feet).

Winter flow.—River occasionally freezes for short periods.

Diversions.—Small tracts aggregating 720 acres are irrigated from Umatilla River above the station, besides some from its tributaries.

Regulation.—Water is stored during the winter in the Furnish reservoir, 5 miles upstream, and released during low water. Capacity of reservoir, about 5,000 acre-feet.

Release of water was begun 5 p. m. June 17, 1915, and reservoir was practically empty August 5. The difference between discharge above reservoir (p. 21) and at that station indicates that 1,070 acre-feet was released in June, 2,480 acre-feet in July, and 275 August 1 to 5.

Accuracy.—Results considered good.

Discharge measurements of Umatilla River at Yoakum, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 15	C. G. Paulsen	3.22	93.9	June 26	Rhea Luper	[a] 3.54	165.
15	.....do	2.90	45.3	29	.....do	[a] 3.51	140
Apr. 19	Eriksen and Pearce	[a] 4.45	524	July 5	W. P. Ward	[a] 3.30	115
May 1	E. T. Eriksen	4.10	399	9	.....do	[a] 3.25	103
June 8	.....do	4.12	405	15	L. A. Reineman	[a] 3.20	65.9
18	L. A. Reineman	3.69	222	21	W. P. Ward	[a] 3.27	107
22	W. P. Ward	[a] 3.49	173	Aug. 28	.....do	[a] 2.65	22.6
24	.....do	[a] 3.55	170				

[a] Measured by wading below Furnish reservoir, about a mile upstream.

River at Yoakum, Oreg., for the year ending 30, 1915.

.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
28	340	2,300	363	1,030	114	87	20
20	260	2,660	363	960	112	88	20
40	228	2,920	363	855	118	76	22
00	242	3,640	386	730	112	35	25
20	465	2,660	610	640	110	31	28
18	610	2,180	760	520	114	28	34
40	580	1,750	790	410	120	28	39
63	520	1,450	700	363	114	31	45
63	492	1,180	640	340	100	33	45
63	492	1,030	640	318	100	33	46
363	492	960	670	293	100	29	52
410	492	890	760	277	100	24	46
410	520	890	1,030	277	94	28	58
363	492	890	1,360	277	68	28	87
318	670	760	1,850	235	78	24	60
363	1,270	670	1,650	208	90	21	60
363	1,180	610	1,450	202	90	20	68
386	1,100	580	1,850	194	90	20	68
410	1,100	550	2,540	179	90	20	68
410	960	520	2,300	174	90	20	68
410	890	465	1,850	156	106	20	69
465	960	410	1,550	163	118	20	68
465	1,030	410	1,360	169	106	19	57
465	1,180	410	1,180	166	100	16	48
465	1,270	363	1,360	174	100	20	58
465	1,030	318	1,270	163	100	20	69
465	820	318	1,270	158	94	20	60
438	760	298	1,360	166	90	20	57
.....	1,180	298	1,550	156	92	20	57
.....	2,070	386	1,450	135	92	20	57
.....	2,300	....	1,180	....	87	20	....

urve well defined above 40 second-feet. Mean discharge
rge relation affected by ice).

Yoakum, Oreg., for the year ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
.....	142	63	101	6,210	B.
.....	179	90	132	7,860	A.
.....	130	....	107	6,580	B.
.....	163	98	123	7,560	A.
.....	700	128	417	23,200	A.
.....	2,300	228	839	51,600	A.
.....	3,640	298	1,090	64,900	A.
.....	2,540	363	1,180	72,600	A.
.....	1,030	135	336	20,000	A.
.....	120	68	99.6	6,120	A.
.....	88	16	29.6	1,820	B.
.....	87	20	52.0	3,090	B.
.....	3,640	16	375	272,000	

ER NEAR UMATILLA, OREG.

. 5 N., R. 28 E., near main line of Oregon-Washo.'s track, about a mile below diversion point canal, and 1½ miles above Umatilla, Umatilla

es.

1903, to September 30, 1915.

ns; lower section 1.2 to 3.5 feet, upper 3.5 to 10.8
er.

e from cable.

ck without gravel or sand. One channel at all

Extremes of discharge.—Maximum stage recorded during year, 4.7 feet March 2 (discharge, 2,450 second-feet); minimum stage recorded, 1.90 feet November 29 to December 1 (discharge, 8 second-feet), probably due to filling pond behind new dam of west extension of Umatilla project, United States Reclamation Service.

1903–1915: Maximum stage recorded, 11.0 feet May 31, 1906 (discharge, 19,600 second-feet); minimum stage recorded, 1.0 foot July 25 and August 1 to 9, 1906 (channel dry).

Winter flow.—Occasionally shore and floating ice, but stage-discharge relation not materially affected.

Diversions.—Large part of total flow of river diverted for irrigation above station. The Umatilla project feed canal also diverts water during the winter for storage in the Cold Springs reservoir. The low-water flow is return water from the Hermiston project and other irrigated tracts.

Regulation.—Practically none.

Accuracy.—Results considered excellent.

Cooperation.—Field data furnished by United States Reclamation Service; records computed by United States Geological Survey.

Discharge measurements of Umatilla River near Umatilla, Oreg., during the year ending Sept. 30, 1915.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Nov. 10	2.52	101
Jan. 8	2.50	83.8

Daily discharge, in second-feet, of Umatilla River near Umatilla, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	128	120	8	105	160	160	1,520	72	770	90	90	79
2	128	120	120	105	160	240	1,660	105	580	90	90	79
3	140	120	120	90	415	216	2,450	90	340	90	90	79
4	140	120	120	90	495	216	2,290	90	270	105	90	79
5	140	114	79	90	415	240	1,970	90	210	120	90	79
6	136	114	120	90	340	455	1,520	90	160	90	86	90
7	132	105	79	90	140	415	1,240	240	120	90	86	90
8	128	102	79	93	105	270	995	210	105	90	86	90
9	124	96	79	93	88	270	770	210	90	90	79	90
10	120	96	90	105	88	140	670	185	90	90	79	86
11	120	96	120	105	86	140	580	270	90	90	79	90
12	120	96	120	111	86	124	415	270	105	90	79	90
13	120	96	120	111	86	124	340	415	120	90	79	90
14	120	96	140	111	86	124	270	580	120	90	79	90
15	120	102	160	111	90	124	210	1,120	120	90	79	90
16	136	105	160	111	90	124	185	1,240	105	90	79	90
17	152	114	160	111	90	720	160	1,240	105	90	79	90
18	160	117	160	111	90	670	120	1,240	105	90	79	90
19	185	117	160	111	105	580	90	1,520	105	120	86	90
20	185	117	152	114	120	538	79	1,820	105	105	86	90
21	185	117	152	114	140	495	90	1,380	105	90	86	90
22	185	117	160	120	140	495	79	1,240	105	90	79	90
23	185	114	160	120	140	495	68	1,120	105	86	79	90
24	185	114	160	120	140	495	64	995	90	79	79	86
25	185	114	160	120	140	580	66	770	90	79	79	88
26	185	114	160	120	140	580	68	770	90	79	79	90
27	120	114	90	140	160	415	68	770	90	79	68	90
28	120	114	90	140	160	415	68	770	90	79	79	90
29	120	8	90	160	......	415	68	880	90	79	79	88
30	120	8	90	140	......	1,180	68	995	90	90	79	88
31	120	......	105	140	......	1,520	......	995	......	90	79	......

Note.—Discharge determined from a well-defined rating curve.

River near Umatilla, Oreg., for the year ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	185	120	143	8,790	A.
....	120	8	103	6,130	A.
....	160	8	121	7,440	B.
....	160	90	113	6,950	A.
....	495	86	161	8,940	A.
....	1,520	124	419	25,800	A.
....	2,450	64	608	36,200	A.
....	1,820	72	703	43,200	A.
....	770	90	159	9,460	A.
....	120	79	90.6	5,570	A.
....	90	68	81.8	5,030	A.
....	90	79	87.7	5,220	A.
....	2,450	8	233	169,000	

UMATILLA RIVER NEAR GIBBON, OREG.

. ¼ sec. 22, T. 3 N., R. 37 E., just above crossing of the
junction of North and South forks of Umatilla River,
ha Springs, and about 10 miles east of Gibbon.

ed.

7, 1912, to December 31, 1915, when station was dis-

irregular intervals by employee of Forest Service.

Made by wading near gage.

vel and small boulders; probably somewhat shifting.

aximum stage recorded during period October 1, 1914,
feet December 22 (discharge, 226 second-feet); maxi-
l-feet (gage height, 1.52 feet) at 1 p. m. April 3. Mini-
foot August 22 to September 7 (discharge, 20 second-

scharge is that of 1915. Maximum not covered by
naxima do not represent the highest stage during the
e probably close to the lowest flow.

ge relation unaffected by ice, as most of water comes

d fair for days on which gage was read. Low water
because of questionable gage readings.

furnished by United States Forest Service, J. M.

th Fork of Umatilla River near Gibbon, Oreg., during the ear ending Sept. 30, 1915.

Made by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	0.65	40.4
....	[a].68	33.6

[a] Gage height questionable.

Daily discharge, in second-feet, of North Fork of Umatilla River near Gibbon, Oreg., from Oct. 1, 1914, to Dec. 31, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1		36	34	34	40		154	74	92	27	23	
2							167		81			
3	46				95		231	74				20
4			32				147					
5					68	60						
6			34	29								
7		34					130		61	27		20
8			34	32				77		30	23	23
9							107	81				
10		34								27		
11	40		34				100		54		23	25
12		46		32				86			23	27
13		49	34	34			130		47			
14		46					107	147				
15							100	137		27	23	
16		46										
17			34	32				155	41			
18		44					96	220		27		
19									37		23	25
20			34	32			118					
21						95		174				
22		36					81			27	20	25
23			32	32				163	33	25		
24						113		123				
25		34					77		41	25	20	
26				32		106						25
27	36		32		60			86				
28		34					74	118	30	23		
29						129		107	27	30	20	
30			32	32			77					25
31		34				141		96				

Daily discharge, in second-feet, of North Fork of Umatilla River, near Gibbon, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1915.											
1	25			11			61	21			61
2		27		12		35		22		69	226
3	41			13	30			23		77	
4			86	14				24		61	
5			64	15				25			77
6	27		69	16	25		41	26	25	45	
7		25		17			35	27			
8				18				28			50
9	25	30	100	19		64		29		41	
10				20	25		37	30			
								31	25		35

NOTE.—Discharge given only for days on which gage was read; determined from rating curves as follows: Oct. 1 to Apr. 3, fairly well defined between 20 and 150 second-feet; Apr. 4 to Dec. 31, poorly defined.

JOHN DAY RIVER BASIN.

JOHN DAY RIVER AT CLARNO, OREG.

LOCATION.—In the NE. ¼ sec. 32, T. 7 S., R. 19 E., at Clarno highway bridge, 14 miles east of Antelope.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 1, 1914, to September 30, 1915, when station was discontinued.

GAGE.—Chain gage on rail of bridge, read by C. T. Craig.

ghway bridge.

nay shift in extreme flood.

recorded during year, 6.4 feet April 4 stage recorded, 0.60 foot September 8 and

determined in 1914 for a flood which ted from an extension of rating curve as 5 probably lowest for some time.

ffected by ice for short periods.

l diversions from John Day River.

r at Clarno, Oreg., during the year ending
), 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 27	P. V. Hodges..........	0.70	78.2
27	......do..................	.70	77.7

ay River at Clarno, Oreg., for the year ending
30, 1915.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
80	850	4,600	1,600	2,300	420	230	72
50	940	4,280	1,600	2,560	420	370	75
210	940	4,280	1,600	2,430	370	370	81
210	940	6,080	1,500	2,180	345	320	86
895	940	4,920	1,500	1,940	345	280	86
810	1,120	4,280	1,500	1,820	320	280	81
690	985	3,660	1,600	1,600	300	262	68
620	940	3,090	1,600	1,500	280	245	65
620	850	2,820	1,710	1,400	585	215	65
620	850	2,560	1,710	1,300	585	215	72
690	810	2,430	1,820	1,260	1,030	184	72
690	810	2,430	2,180	1,260	690	156	81
620	810	2,690	2,430	1,400	550	156	86
620	985	2,690	2,690	1,500	480	132	93
550	1,400	2,560	3,230	1,400	450	122	97
480	2,060	2,430	3,090	1,210	420	122	111
515	2,060	2,180	2,820	1,030	450	122	200
585	2,060	2,300	2,560	895	420	115	200
690	2,300	2,180	2,690	850	370	107	200
985	2,180	2,060	2,560	770	370	102	200
1,030	2,060	2,060	2,430	690	370	102	200
940	2,180	2,060	2,300	690	370	102	200
940	2,430	2,060	2,300	655	320	102	184
850	2,820	1,820	2,430	620	320	97	156
810	2,560	1,600	2,560	550	280	93	144
850	2,180	1,500	2,430	550	262	93	156
1,030	2,060	1,300	2,300	550	230	86	156
940	1,940	1,260	2,300	480	215	75	156
....	2,560	1,210	2,300	480	320	72	156
....	4,920	1,210	2,820	480	245	72	156
....	4,600	....	2,430	....	245	72	....

ll-defined rating curve.

Monthly discharge of John Day River at Clarno, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	550	300	409	25,100	A.
November	450	320	393	23,400	A.
December	420	184	310	19,100	B.
January	480	280	392	24,100	B.
February	1,210	480	779	43,300	A.
March	4,920	810	1,780	109,000	A.
April	6,080	1,210	2,690	160,000	A.
May	3,230	1,500	2,210	136,000	A
June	2,560	480	1,210	72,000	A.
July	1,030	215	399	24,500	A.
August	370	72	164	10,100	A.
September	200	65	125	7,440	B.
The year	6,080	65	904	654,000	

JOHN DAY RIVER AT McDONALD, OREG.

Location.—In the NW. ¼ sec. 11, T. 1 N., R. 19 E., at the ferry at McDonald post office, Sherman County, half a mile below mouth of Rock Creek, 16 miles above junction with Columbia River, and 18 miles southwest of Arlington.

Drainage area.—7,800 square miles.

Records available.—December 16, 1904, to September 30, 1915.

Gage.—Inclined staff in two sections on left bank, 183 feet above ferry cable. Gage reader, William G. McDonald.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Clean gravel and sand; shifts slightly. Banks high. One channel at all stages.

Extremes of discharge.—Maximum stage recorded during year, 5.1 feet at 6 p. m. April 4 and 6 a. m. April 5 (discharge, 5,870 second-feet); minimum stage recorded, 1.02 feet September 8 to 11 (discharge, 63 second-feet).

1905–1915: Maximum stage recorded, 10.38 feet February 6, 1907 (discharge, 22,800 second-feet). A flood about 20 years ago is said to have reached a height of 12.8 feet (discharge estimated from extension of rating curve as 33,000 second-feet). Minimum is that of 1915.

Winter flow.—Stage-discharge relation affected by ice for short periods.

Diversions.—Large part of natural low-water flow of stream diverted in the upper John Day Valley for irrigation.

Regulation.—None.

Accuracy.—Results excellent except for periods during which river was obstructed by ice or was at extremely low stage.

Discharge measurements of John Day River at McDonald, Oreg., during the year ending Sept. 30, 1915.

[Made by P. V. Hodges.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 9	2.90	1,500
Aug. 28	1.10	84.8

ohn Day River at McDonald, Oreg., for the year ending Sept. 30, 1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
705	750	1,120	4,680	1,820	2,620	474	259	70
705	950	1,060	5,140	1,750	2,800	396	334	70
660	1,060	1,120	4,680	1,680	2,800	396	347	63
570	1,540	1,120	5,140	1,610	2,620	382	347	68
570	1,290	1,170	5,620	1,680	2,360	375	328	72
570	1120	1,170	4,910	1,680	2,120	361	286	72
660	900	1,290	4,220	1,750	1,820	334	259	70
660	750	1,120	3,780	1,750	1,680	328	254	63
660	705	1,120	3,370	1,820	1,540	340	213	63
660	705	1,000	3,170	1,820	1,480	660	199	63
660	660	950	2,800	1,820	1,410	900	180	63
705	750	950	2,620	1,970	1,410	1,060	165	70
660	750	1,000	2,620	2,200	1,540	850	147	70
615	705	1,060	2,800	2,620	1,680	705	133	80
490	615	1,120	2,980	2,980	1,540	570	133	82
570	570	1,610	2,620	3,780	1,410	506	117	82
570	554	2,360	2,450	3,570	1,290	458	102	77
522	530	2,200	2,280	2,980	1,170	850	110	93
474	570	2,200	2,200	2,980	1,060	850	107	117
410	660	2,620	2,200	2,980	1,060	750	104	158
570	1,060	2,280	2,280	2,980	950	660	102	158
450	1,120	2,280	2,120	2,980	850	660	96	147
410	1,120	2,620	2,120	2,800	800	570	96	143
375	1.120	2,800	1,970	2,620	750	490	96	143
403	1,170	3,170	1,820	2,620	705	450	96	143
442	1,060	2,980	1,680	2,800	705	347	96	143
474	1,060	2,620	1,540	2,620	660	275	85	140
522	1,060	2,280	1,410	2,620	615	227	82	136
570	....	2,360	1,290	2,620	570	199	82	143
660	....	3,370	1,750	2,620	530	204	80	143
750	....	5,140	....	2,620	....	218	72	....

vell defined rating curve. Stage-discharge relation affected by mparison with record of flow at Clarno.

River at McDonald, Oreg., for the year ending Sept. 30, 1915.

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
Maximum.	Minimum.	Mean.		
615	280	417	25,600	A.
450	340	406	24,200	A.
....	....	353	21,700	C.
750	375	572	35,200	C.
1,540	530	889	49,400	A.
5,140	950	1,910	117,000	A.
5,620	1,290	2,940	175,000	A.
3,780	1,610	2,420	149,000	A.
2,800	530	1,420	84,500	A.
1,060	199	511	31,400	A.
347	72	165	10,100	A.
158	63	100	5,950	B.
5,620	63	1,010	729,000	

CAMAS CREEK ABOVE CABLE CREEK, NEAR UKIAH, OREG.

Location.—In the SE. ¼ sec. 4, T. 5 S., R. 32 E., at highway bridge 200 feet above mouth of Cable Creek and 6 miles east of Ukiah, Umatilla County.

Drainage area.—Not measured.

Records available.—May 1, 1914, to September 30, 1915.

Gage.—Vertical staff on abutment of highway bridge.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Rock and gravel; probably permanent.

Extremes of discharge.—Maximum stage recorded May 1, 1914, to September 30, 1915, 3.2 feet at 7 a. m. April 3 (discharge, 770 second-feet); minimum stage recorded, 0.50 foot August 29 to 31, 1914 (discharge, 3 second-feet). Discharge estimated to have become as low as 2 second-feet in December, 1914.

Winter flow.—Stream freezes almost solid during severe winter weather.

Diversions.—Practically none.

Regulation.—None.

Accuracy.—Results considered good except for periods during which stream is frozen, for which they are poor.

Discharge measurements of Camas Creek above Cable Creek, near Ukiah, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	C. G. Paulsen..........	0.85	12.4	Mar. 8	C. G. Paulsen..........	[a]0.99	20.3
Jan. 10	.....do..................	[a]2.46	3.5	July 20	H. M. Nelson..........	.75	9.2

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Camas Creek above Cable Creek, near Ukiah, Oreg., for the years ending Sept. 30, 1914 and 1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1914.						1914.					
1	122	30	22	5.5	3.2	16	122	186	11	3.2	10
2	133	30	22	4.0	3.2	17	94	133	9.0	3.2	11
3	158	64	22	4.0	3.2	18	86	112	9.0	3.2	9.0
4	158	46	30	4.0	3.2	19	78	112	7.0	3.2	9.0
5	146	46	30	4.0	3.2	20	71	78	7.0	3.2	10
6	122	40	19	4.0	3.5	21	64	64	7.0	3.2	9.0
7	112	52	16	4.0	3.5	22	64	64	7.0	3.5	7.0
8	112	52	19	4.0	4.6	23	64	52	7.0	3.5	6.4
9	146	52	16	4.0	4.6	24	78	52	7.0	3.5	6.4
10	133	52	16	4.0	4.0	25	71	52	7.0	3.5	6.4
11	112	46	14	3.5	4.0	26	64	46	5.5	3.5	6.4
12	103	46	19	3.5	5.5	27	52	40	5.5	3.2	6.4
13	94	445	14	3.5	4.6	28	52	30	5,5	3.0	6.4
14	94	350	12	3.5	5.5	29	40	30	5.5	3.0	6.4
15	122	250	11	3.5	12	30	40	30	5.5	3.0	6.4
						31	35	......	5.5	3.0	......

of Camas Creek above Cable Creek, near Ukiah, Oreg., ng Sept. 30, 1914, and 1915—Continued.

Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
30	7	470	52	172	16	9.0	3.5
26	11	420	52	153	15	9.0	3.5
16	16	770	52	133	14	9.0	3.5
16	16	520	71	94	11	7.8	3.5
22	19	370	133	78	16	6.4	3.5
11	16	290	153	71	14	6.4	3.5
19	22	216	146	64	22	5.5	3.5
15	22	186	133	52	16	5.5	3.8
11	22	158	133	46	17	5.5	3.8
11	22	133	133	32	16	5.5	3.8
11	26	133	129	52	12	4.6	3.8
9	30	122	153	78	11	4.6	4.6
6	35	146	158	58	11	4.6	7.8
6	52	116	350	58	9.0	4.0	7.8
4	94	108	330	46	11	4.0	7.0
3	94	94	250	38	11	4.0	7.0
2	112	94	223	32	16	5.5	6.4
2	158	86	216	30	15	5.5	5.5
2	112	86	186	26	11	5.5	5.5
2	112	78	158	26	10	5.5	5.5
3	180	78	133	26	10	4.0	5.5
3	216	71	158	22	9.0	4.0	5.5
3	290	64	146	26	7.8	4.0	5.5
3	250	58	158	22	7.0	4.0	4.6
3	216	52	192	19	6.4	4.0	4.6
2	145	52	180	22	6.4	4.0	4.6
3	133	52	186	19	6.4	3.8	5.5
3	158	40	290	19	6.4	3.8	5.5
3	520	40	233	19	9.0	3.8	5.5
4	520	58	186	17	14	3.8	5.5
7	520	....	158	....	9.0	3.8	....

rating curve fairly well defined between 10 and 700 second-feet; rom observer's notes, current meter measurements, and records Mar. 6; mean discharge estimated as 4 second-feet Jan. 1-15 and nd-feet, Feb. 11-20; 6 second-feet, Feb. 21-26.

k above Cable Creek, near Ukiah, Oreg., for the years g Sept. 30, 1914 and 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	158	35	94.9	5,840	B.
....	445	30	89.4	5,320	B.
....	30	5.5	12.7	781	B.
....	5.5	3.0	3.58	220	C.
....	12	3.2	6.13	365	C.
....	....	....	....	12,500	
....	14	6.4	9.81	603	B.
....	12	7.0	9.17	546	B.
....	30	2.0	8.42	518	D.
....	....	....	3.5	215	D.
....	....	....	5.0	278	D.
....	520	7.0	134	8,240	B.
....	770	40	172	10,200	B.
....	350	52	169	10,400	B.
....	172	17	51.7	3,080	B.
....	22	6.4	11.8	726	B.
....	9.0	3.8	5.17	318	B.
....	7.8	3.5	4.97	296	B.
....	770	2.0	48.9	35,400	

CABLE CREEK NEAR UKIAH, OREG.

Location.—In the NE. ¼ sec. 9, T. 5 S., R. 32 E., at highway bridge about 1,000 feet above the mouth of the creek, about 6 miles east of Ukiah, Umatilla County.

Drainage area.—Not measured.

Records available.—May 1, 1914, to September 30, 1915.

Gage.—Vertical staff on abutment of bridge.

Discharge measurements.—Made from highway bridge or by wading.

Channel and control.—Gravel and rock; uneven, but practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 1.40 feet at 5.30 p. m. April 3 (discharge, 156 second-feet); minimum stage recorded, 0.05 foot August 28 to September 11 (discharge, 1.5 second-feet). Discharge estimated to have practically ceased December 22 to 31, when stream was frozen.

Winter flow.—Stream freezes and may go almost dry in extremely cold weather.

Diversions.—Probably none.

Regulation.—None.

Accuracy.—Records considered fair; those for periods during which stream was frozen, poor.

Discharge measurements of Cable Creek near Ukiah, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	C. G. Paulsen	0.26	5.3	Mar. 8	C. G. Paulsen	[b]0.25	6.0
Jan. 10	do	[a].78	1.9	July 20	H. M. Nelson	.21	4.1

[a] Stage-discharge relation affected by ice.
[b] Water running nearly free under ice cover.

Daily discharge, in second-feet, of Cable Creek near Ukiah, Oreg., for the years ending Sept. 30, 1914 and 1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug,	Sept.
1914.						1914.					
1	70	16	13	3.0	1.5	16	46	57	6.0	1.5	6.0
2	74	16	13	2.0	1.5	17	42	46	4.0	1.5	6.0
3	88	28	13	2.0	1.5	18	37	37	4.0	1.5	4.0
4	88	20	13	2.0	1.5	19	37	37	4.0	1.5	3.6
5	92	20	13	2.0	1.5	20	32	37	4.0	1.5	4.0
6	64	20	8.0	2.0	1.5	21	28	32	4.0	1.5	4.0
7	64	24	8.0	2.0	1.5	22	28	28	4.0	1.5	3.6
8	70	24	10	2.0	2.4	23	28	28	4.0	1.5	3.0
9	70	24	8.0	2.0	2.4	24	32	28	4.0	1.5	3.0
10	64	24	8.0	2.0	2.0	25	32	28	4.0	1.5	2.4
11	57	20	8.0	1.5	1.8	26	28	24	3.0	1.5	2.4
12	48	24	8.0	1.5	2.0	27	20	20	3.0	1.5	2.4
13	46	132	8.0	1.5	2.0	28	20	20	3.0	1.5	2.4
14	46	88	6.0	1.5	2.4	29	20	20	3.0	1.5	2.4
15	52	70	6.0	1.5	7.2	30	20	20	3.0	1.5	2.4
						31	16	......	3.0	1.5	......

Cable Creek near Ukiah, Oreg., for the years ending *), 1914 and 1915*—Continued.

Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
4	4	70	22	64	8.0	4.8	1.5
3	4	70	22	52	8.0	4.0	1.5
4.8	4	132	24	46	8.0	4.0	1.5
4	4	88	30	42	7.2	3.0	1.5
4	5	70	32	37	7.2	3.0	1.5
4	5	57	42	32	6.0	3.0	1.5
6	6	57	42	28	10	3.0	1.5
6	7.2	46	46	28	13	3.0	1.5
6	6	46	46	24	13	3.0	1.5
6	8	46	55	24	10	2.4	1.5
4	8	46	52	28	9.0	2.4	1.5
6	8	46	57	42	9.0	2.4	1.8
4	10	57	60	32	6.0	2.0	4.0
4	14	46	99	24	6.0	2.0	4.0
4	35	46	79	24	6.0	2.0	3.0
4	30	44	64	20	6.0	2.0	3.0
3	32	46	64	19	8.0	2.0	3.0
3	37	42	57	19	7.2	2.0	3.0
3	37	42	57	16	6.0	2.0	2.4
3	37	42	55	16	6.0	2.0	2.0
1	35	37	46	14	4.8	2.0	2.0
0	28	42	57	13	6.0	2.0	2.0
0	36	30	52	14	6.0	2.0	2.0
0	32	28	55	13	6.0	2.0	1.8
0	28	28	60	10	6.0	2.0	1.8
0	22	26	57	12	3.6	2.0	1.8
0	20	22	57	9	3.0	2.0	2.0
0	24	20	110	10	3.0	1.5	2.0
0	57	20	70	8	4.0	1.5	2.0
0	70	26	68	8	7.2	1.5	2.0
0	88	....	64	....	6.0	1.5	....

rating curve fairly well defined between 5 and 300 second-feet; not
ge estimated, on account of ice, from current-meter measurements,
ture records, Dec. 9 to Mar. 6; mean discharge estimated Jan. 1–10,
nd-feet; Feb. 11–20, 3 second-feet; Feb. 21–28, 4 second-feet.

k near Ukiah, Oreg., for the years ending Sept. 30, 1914 *and 1915.*

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	92	16	47.1	2,900	B.
....	132	16	33.7	2,010	B.
....	13	3.0	6.55	403	B.
....	3.0	1.5	1.69	104	C.
....	7.2	1.5	2.81	167	C.
....	....	....	....	5,580	
....	8.0	2.4	4.17	256	C.
....	4.8	3.0	3.63	216	C.
....	6.0	0	2.8	172	
....	....	....	1.7	105	
....	....	....	2.7	150	
....	88	4.0	23.9	1,470	B.
....	132	20	47.3	2,810	B.
....	110	22	54.9	3,380	B.
....	64	8.0	24.3	1,450	B.
....	13	3.0	6.94	427	B.
....	4.8	1.5	2.39	147	C.
....	4.0	1.5	2.07	123	C.
....	132	0	14.8	10,700	

DESCHUTES RIVER BASIN.

DESCHUTES RIVER AT CRANE PRAIRIE, NEAR LAPINE, OREG.

LOCATION.—In sec. 17, T. 21 S., R. 8 E., at outlet of Crane Prairie, above proposed dam site and below mouth of Cultus River, and about 28 miles west of Lapine by road.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—January 1, 1914, to September 30, 1915; fragmentary gage readings 1907 to 1913.

GAGE.—Vertical staff on bent of footbridge; read once a week by George E. Graft.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Channel, sand, and gravel, somewhat shifting; control some distance below station, rocky and fairly permanent. Stage-discharge relation slightly affected by growth of aquatic plants and by tree felled across river near control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.90 feet October 4 and 8 (discharge, 290 second-feet); minimum stage recorded, 1.20 feet September 26 (discharge, 145 second-feet).

1907–1915: Maximum stage from fragmentary records, 2.75 feet about July 31, 1913 (determined from high-water marks on September 15; discharge, 531 second-feet). Minimum stage, 1.20 feet September 26, 1915 (discharge, 145 second-feet).

WINTER FLOW.—Ice jammed at the fallen tree may affect the stage-discharge relation during extremely cold weather.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Results good except for periods during which stage-discharge relation is affected by ice.

Discharge measurements of Deschutes River at Crane Prairie, near Lapine, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 22	J. E. Stewart	1.37	161
July 28	P. V. Hodges	1.31	176

of Deschutes River at Crane Prairie, near Lapine, Oreg.,
he year ending Sept. 30, 1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
......	......	......	......	220	......	190	200	......
......	190	......	......	......	......	......	......	......
196	......	180	......	......	240	......	......	......
......	......	......	......	......	......	......	......	......
......	......	......	252	......	......	......	......	......
......	......	......	220	......	......	......	......	160
......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	200	......
......	......	......	......	220	220	......	......	......
......	180	......	......	......	......	......	......	......
......	......	......	......	......	......	180	......	......
......	......	......	210	......	......	......	......	......
......	......	180	......	240	......	......	......	......
......	......	......	......	......	......	......	......	......
......	......	......	......	......	220	......	......	160
......	......	......	......	......	......	......	......	......
......	170	......	......	......	......	......	......	......
......	......	......	......	240	......	180	180	......
......	180	......	240	......	......	......	......	160
......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......
......	170	190	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......
180	......	200	......	......	200	180	......	......
......	180	......	220	240	......	......	......	145
......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	160	160	......
......	......	......	......	......	......	......	......	......
......	......	240	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......

fairly well-defined rating curve. Stage-discharge relation affected

iver at Crane Prairie, near Lapine, Oreg., for the year
ending Sept. 30, 1915.

off in et).	Accuracy.	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Accuracy.
900	B.	May	232	14,300	B.
600	B.	June	220	13,100	B.
300	C.	July	178	10,900	B.
700	C.	August	185	11,400	B.
890	B.	September	156	9,280	B.
200	B.				
600	B.	The year	189	149,000	

erage of discharge determined for days on which gage was read,
, which was estimated.

S RIVER NEAR LAPINE, OREG.

, T. 20 S., R. 10 E., at Forest Service bridge at Big
by river above mouth of East Fork, 11 miles north

e.

r 22 to December 21, 1910; February 18 to Decem-
ober 27, 1913, occasional readings; October 1, 1914,

bridge; gage reader, Burton Oney.
ade from upstream side of wagon bridge. Condi-

Channel and control. Stream bed, gravel and sand; no defined control. Channel crooked, apparently permanent; gradient low.

Extremes of discharge. Maximum unaffected stage recorded during year, 1.4 feet October 1 and 9 (discharge, 1,020 second-feet); minimum stage recorded, 0.5 foot August 9 to September 21 (discharge, 800 second-feet). Maximum stage (ice affected), 4.0 feet December 16 and 17.

For extremes during period 1905 to 1915 see "Deschutes River near Lava" (p. 37).

Winter flow. Stage-discharge relation materially affected by ice in December, 1914, but this condition seldom occurs.

Diversions. None.

Regulations. None.

Accuracy. Results considered good.

Cooperation. Gage readings furnished by United States Forest Service, M. S. Merritt, supervisor.

Discharge measurements of Deschutes River near Lapine, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 3	J. E. Stewart	1.16	954	Feb. 19	J. E. Stewart	0.66	828
Dec. 16	.....do	[a] 4.00	854	Mar. 11	P. V. Hodges	.55	827
Jan. 31	C. G. Paulsen	.66	892	July 29	.....do	.59	804

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Deschutes River near Lapine, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.
1	1,020	965	915	890	865	820	865	840	820	820	800
2	990	965	915	865	865	820	890	840	820	820	800
3	990	965	915	865	865	820	890	845	820	820	800
4	990	965	915	865	840	820	890	845	820	820	800
5	990	965	915	865	840	820	865	845	820	810	800
6	990	965	915	865	820	820	865	850	840	810	800
7	990	965	915	865	820	820	865	850	840	810	800
8	990	965	915	865	820	820	865	850	840	810	800
9	1,020	965	915	865	820	820	865	855	820	800	800
10	990	965	915	865	820	820	840	855	820	800	800
11	990	965	915	865	820	820	840	855	820	800	820
12	990	940	915	865	820	820	840	860	820	800	820
13	990	940	915	865	820	820	865	860	820	800	820
14	985	940	940	865	820	820	865	860	820	800	820
15	985	940	900	865	820	820	865	865	820	800	820
16	985	935	....	865	820	820	860	865	820	800	800
17	985	930	....	865	820	820	860	865	820	800	800
18	980	925	....	865	840	820	855	865	820	800	800
19	980	920	....	865	820	820	850	865	820	800	800
20	980	915	....	840	820	820	845	865	820	800	800
21	980	915	....	840	820	820	845	865	820	800	800
22	975	915	....	840	820	820	840	860	820	800	800
23	975	915	....	840	840	825	840	855	820	800	800
24	975	915	....	840	840	830	840	850	820	800	800
25	975	915	....	840	840	840	840	845	820	800	800
26	970	915	....	840	820	850	840	840	820	800	800
27	970	915	....	840	820	855	840	840	820	800	800
28	970	915	....	840	820	860	840	840	820	800	800
29	970	915	915	820	....	865	840	840	820	800	800
30	965	915	915	820	....	865	840	840	820	800	800
31	965	....	890	820	....	865	....	840	820	800	....

Note.—Discharge determined from a well-defined rating curve. Discharge interpolated Oct. 11 to Nov. 1, Sept. 22-30, and for occasional periods of 1 to 6 days when gage was not read; also Jan. 22-24 on account of obstruction by ice. Water backed up by ice jam Dec. 15-28; mean discharge estimated as 850 second-feet. Gage not read June 1-30; mean discharge estimated at 830 second-feet.

Lapine, Oreg., for the year ending Sept. 30,
5.

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
Maximum.	Minimum.	Mean.		
1,020	965	984	60,500	B.
965	915	938	55,800	A.
940	....	887	54,500	B.
890	820	854	52,500	A.
865	820	829	46,000	A.
865	820	829	51,000	A.
890	840	855	50,900	A.
865	840	852	52,400	A.
....	....	a 830	49,400	B.
840	820	822	50,500	A.
820	800	804	49,400	A.
820	800	803	47,800	A.
1,020	800	858	621,000	

imated.

R NEAR LAVA, OREG.

, R. 10 E., about 1½ miles west of the former
mouth of East Fork (locally called Little
Bend, Deschutes County.

, to April 14, 1907; April 23, 1909, to January
912; October 18, 1913, to January 31, 1915,

d once a week by Mrs. C. B. Allen.
n bridge at Big River ranger station, about

and, and gravel; somewhat shifting. Con-
tation may be affected by growth of aquatic
Fork is relatively high.

open-channel stage recorded October 1, 1914,
r 20 (discharge, 1,060 second-feet); maximum
ber 20. Minimum stage recorded, 7.85 feet
eet).
ded, 11.50 feet, November 26, 1909 (discharge
recorded, 7.18 feet at time of measurement,
econd-feet).
is stream, but ice jams may form in extremely

ght uncertainties due to effect of backwater.

er near Lava, Oreg., during the year ending Sept.
30, 1915.

by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	8.32	954
....	a 10.45	854
....	7.85	892

rge relation affected by ice.

anger station near Lapine and referred to gage at Lava.

d.

Daily discharge, in second-feet, of Deschutes River near Lava, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1		1,010			16			854	
2					17				
3		985		916	18	1,010			
4	1,010				19				
5					20	1,060		850	
6			939		21				
7					22		962		
8					23				
9		985		916	24				
10					25	1,010			
11	1,010				26				
12					27			870	
13			916		28				
14					29		962		
15		962			30				
					31				893

NOTE.—Discharge given only for days on which gage was read; determined from a well-defined rating curve. Discharge estimated, on account of ice, Dec. 20 and 27, from current-meter measurement made Dec. 16 at Big River ranger station near Lapine.

Monthly discharge of Deschutes River mear Lava, Oreg., for the year ending Sept. 30, 1915.

Month.	Mean Discharge in second-feet.	Run-off total in acre-feet.	Accuracy.
October	1,020	62,700	B.
November	978	58,200	B.
December	886	54,500	B.
January	908	55,800	B.

NOTE.—Monthly mean discharge is average of discharge determined for days on which gage was read.

DESCHUTES RIVER AT LAVA ISLAND, NEAR BEND, OREG.

LOCATION.—In the SE. ¼ sec. 27, T. 18 S., R. 11 E., at remains of an old log bridge half a mile above upper end of Lava Island and intake of Arnold canal, and about 10 miles south of Bend, Deschutes County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 30 to September 30, 1915. Discharge is the same as at the stations at Benham Falls and West's ranch, January 1, 1905, to January 29, 1915.

GAGE.—Vertical staff nailed to a clump of willows on right bank about 600 feet above the intake of Arnold canal; read three times a week by Joe Stenkamp.

DISCHARGE MEASUREMENTS.—Made from logs of old bridge about three-eighths mile above gage; section relatively deep and narrow; conditions fairly good.

CHANNEL AND CONTROL.—Stream bed rocky; practically permanent. Control is a riffle just above head of Lava Island Falls; stage-discharge relation may be affected by changes in a wing dam used to divert water into Arnold canal.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.20 feet April 5 (discharge, 1,540 second-feet); minimum stage recorded, 1.65 feet June 25; minimum discharge, 1.070 second-feet (gage height, 1.68 feet) July 25, 27, August 3 to 8, September 3 to 7, 19 to 30.

1905–1915: Maximum stage recorded, 3.45 feet at pumping plant at Bend at 7.45 a. m. November 27, 1909 (discharge, 4,820 second-feet; no diversions). Minimum stage, 3.2 feet at Benham Falls station January 4, 1912 (discharge, 1,000 second-feet).

WINTER FLOW.—Stage-discharge relation practically never affected by ice.

ater diverted for irrigation above station negligible; ice, Arnold canal, just below gage. Between the gage ater from the river passes into Lost Creek, which dis- east of the river. The measured flow of Lost Creek was 17, 40.2 second-feet April 18, and 30.0 second-feet June e. It is believed, though not proved, that the water returned to the river near the lower end of Lava Island

ept December to January, for which discharge was hat uncertain record below Bend.

hutes River at Lava Island, near Bend, Oreg., during the year ending Sept. 30, 1915.

Made by—	Gage height.	Dis- charge.
	Feet.	*Sec.-ft.*
	1.84	1,240
	2.00	1,370
	1.71	1,180

of Deschutes River at Lava Island, near Bend, Oreg., year ending Sept. 30, 1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
......	1,260	1,300	1,450	1,340	1,300	1,140	....	1,080
......	1,280	1,300	1,450	1,340	1,300	....	1,080	....
......	1,260	1,300	1,480	1,340	1,300	1,120	....	1,070
......	1,240	1,300	1,510	1,360	1,300	....	1,070	....
......	1,230	1,300	1,540	1,370	1,260	1,120	....	1,070
......	1,230	1,280	1,500	1,340	1,260	....	1,070	....
......	1,230	1,260	1,470	1,310	1,240	1,100	....	1,070
......	1,230	1,240	1,460	1,310	1,230	....	1,070	....
......	1,240	1,250	1,450	1,310	1,230	1,110	....	1,080
,530	1,240	1,260	1,420	1,310	1,230	....	1,080	....
,520	1,240	1,250	1,400	1,310	1,230	1,080	....	1,080
,520	1,230	1,240	1,370	1,310	1,230	....	1,080	....
,520	1,230	1,270	1,370	1,340	1,220	1,080	....	1,100
,520	1,230	1,290	1,370	1,370	1,220	....	1,080	....
,450	1,230	1,320	1,380	1,370	1,220	1,080	....	1,100
,450	1,240	1,320	1,380	1,370	1,220	....	1,080	....
,450	1,260	1,320	1,380	1,370	1,200	1,080	....	1,080
,450	1,280	1,320	1,370	1,360	1,180	....	1,080	....
,460	1,290	1,320	1,370	1,340	1,170	1,080	....	1,070
,410	1,290	1,320	1,370	1,310	1,170	....	1,080	....
360	1,290	1,320	1,370	1,310	1,170	1,080	....	1,070
310	1,290	1,320	1,370	1,300	1,170	....	1,080	....
260	1,290	1,340	1,370	1,300	1,170	1,080	....	1,070
320	1,290	1,350	1,380	1,310	1,160	....	1,080	....
320	1,300	1,370	1,380	1,340	1,140	1,070	....	1,070
380	1,300	1,390	1,390	1,340	1,150	....	1,080	....
440	1,300	1,380	1,380	1,310	1,140	1,070	....	1,070
350	1,300	1,380	1,370	1,300	1,150	....	1,080	1,070
200	....	1,380	1,360	1,300	1,140	1,080	....	....
260	....	1,450	1,340	1,300	1,140	....	1,080	1,070
240	....	1,450	....	1,300	....	1,080	....	....

o well-defined rating curves, one applicable Jan. 20 to June 25, ; indirect method for shifting channels used June 26 to July 7. s sum of discharge of Deschutes River at Bend and of Arnold, Nov. 22 to Jan. 29, as sum of discharge of Deschutes below Bend tte, North, and Swalley canals. Mean discharge estimated as econd-feet Dec. 13-17, 1,200 second-feet Dec. 19-25, 1,450 second- 1-9. Discharge interpolated between results of readings three 24-30.

Monthly discharge of Deschutes River at Lava Island, near Beno, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	1,480	1,270	1,370	84,200	B.
November	1,360	1,280	1,320	78,600	B.
December	....	....	1,260	77,500	C.
January	1,530	1,200	1,430	87.900	C.
February	1,300	1,230	1,260	70,000	A.
March	1,450	1,240	1,320	81,200	A.
April	1,540	1,340	1,410	83,900	A.
May	1,370	1,300	1,330	81,800	A.
June	1,300	1,140	1,210	72,000	A.
July	1,140	1,070	1,090	67,000	B.
August	1,080	1,070	1,080	66,400	A.
September	1,100	1,070	1,080	64,300	A.
The year	1,540	1,070	1,260	915,000	

DESCHUTES RIVER AT BEND, OREG.

Location.—In the NE. ¼ sec. 32, T. 17 S., R. 12 E., just below the power house of the Bend Water, Light & Power Co. at former city pumping plant at Bend, Deschutes County, a mile above the diversion dam of the North canal of the Central Oregon Irrigation Co.

Drainage area.—Not measured.

Records available.—April 23, 1907, to October 8, 1910, and October 1, 1911, to November 21, 1914, when station was discontinued, at gage below power house; December 22, 1904, to March 30, 1907, at Sizemore's bridge; October 1, 1910, to April 10, 1912, at gage above dam.

Gage.—At pumping plant, vertical staff bolted to a boulder; above dam, vertical staff nailed to pier of bridge over pond near right bank; zero level with crest; at Sizemore's bridge (prior to 1907), vertical staff spiked to bent. Gage reader, C. A. Stanburrough.

Discharge measurements.—Made from a bridge a short distance above gage. Prior to August 24, 1912, made from Staat's bridge, three-fourths mile above the gage; October 18, 1912, to June 1, 1913, from a cable at gage.

Channel and control.—Gravel and boulders on which logs and drift are lodged; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during period October 1 to November 21, 1914, 1.55 feet October 22 (discharge, 1,480 second-feet); minimum stage recorded, 1.10 feet October 28 (discharge, 1,060 second-feet).

1905–1915: Maximum stage recorded, 3.45 feet at 7.45 a. m. November 27, 1909 (discharge, 4,820 second-feet; no diversions); minimum discharge, 539 second-feet August 14, 1915 (found by adding discharge of Deschutes River below Bend and that of North and Swalley canals).

Winter flow.—Stage-discharge relation not seriously affected by ice.

Diversions.—The Arnold, Pilot Butte, and Central Oregon canals divert water above station; records available. No other important diversions.

Regulation.—Discharge fluctuates owing to operation of power plant just above station. Gage has generally been read after load on plant has been steady for a time.

Accuracy.—Results considered good.

No discharge measurements made October 1 to November 21, 1915.

, of Deschutes River at Bend, Oreg., for the period Oct. 1 to Nov. 21, 1914.

Day.	Oct.	Nov.	Day.	Oct.	Nov.
	1,150	1,150	21	1,430	1,280
	1,150	1,100	22	1,480	....
	1,380	1,330	23	1,430	....
	1,380	1,330	24	1,430	....
	1,380	1,330	25	1,150	....
	1,380	1,330	26	1,150	....
	1,330	1,330	27	1,150	....
	1,360	1,330	28	1,060	....
	1,380	1,330	29	1,330	....
	1,430	1,280	30	1,330	....
			31	1,330	....

well-defined rating curve. Discharge interpolated Oct. 18, Nov. 1 allowance for change in diversions, Oct. 25, Nov. 8, 9, and 13.

River at Bend, Oreg., for the period Oct. 1 to Nov. 21, 1914.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
	1,480	1,060	1,320	81,200	B.
	1,330	1,100	1,290	53,700	B.

S RIVER BELOW BEND, OREG.

0, T. 17 S., R. 12 E., half a mile below North canal end, Deschutes County.

d.

er 27, 1914, to September 30, 1915.

ler on right bank; inspected by C. Orewiler.

ade from cable about 50 feet upstream from gage.

y and probably permanent. Some logs and drift control may affect stage-discharge relation slightly.

imum stage recorded during year, 2.15 feet April 5); recorder not working and actual peak may have ge from water-stage recorder, 0.51 foot at 2 a. m. d-feet). This is the lowest flow ever known at this d see description of station at Bend (p. 40).

elation seldom affected by ice.

he intakes of the five large canals which divert from only small diversions below.

y a small hydroelectric plant at North canal dam.

ell defined above 1,000 second-feet and gage record ecember, January, March, and September. Record ellent.

tes River below Bend, Oreg., during the year ending Sept. 30, 1915.

.	Discharge.	Date.	Made by—	Gage height.	Discharge.
	Sec.-ft.			*Feet.*	*Sec.-ft.*
	1,210	June 17	F. F. Henshaw	1.00	354
	1,110	20	do	.92	328
	1,190	July 31	P. V. Hodges	.91	307
	1,260	Sept. 30	Henshaw and Batchelder	1.18	493
	1,060				

rge relation affected by anchor ice.

Daily discharge, in second-feet, of Deschutes River below Bend, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,070	1,170	1,190	....	1,240	1,220	1,300	750	540	285	240	....
2	1,110	1,170	1,250	....	1,240	1,300	1,330	750	540	398	240	....
3	1,060	1,140	1,250	....	1,220	1,120	1,360	710	540	285	220	....
4	1,070	1,160	1,080	....	1,210	1,120	1,430	700	500	240	220	....
5	1,170	1,110	860	....	1,200	1,120	1,500	690	500	220	220	190
6	1,170	1,110	1,190	....	1,180	1,240	1,460	680	465	220	220	....
7	1,170	1,110	....	....	1,180	1,240	1,430	670	430	240	205	....
8	1,220	1,110	....	....	1,210	1,270	1,400	660	398	240	205	....
9	1,220	1,110	....	....	1,240	1,300	1,360	660	398	240	205	....
10	1,220	980	....	1,500	1,240	1,270	1,320	705	398	240	240	....
11	940	980	....	1,500	1,240	1,240	950	660	398	285	270	285
12	940	930	1,190	1,500	1,240	1,240	985	660	365	285	250	....
13	1,170	1,160	....	1,500	1,240	1,240	1,020	660	365	220	190	....
14	1,170	1,160	....	1,500	1,120	1,240	985	660	450	220	170	....
15	1,170	1,160	....	1,430	1,060	1,240	950	705	450	220	190	....
16	1,170	1,160	....	1,430	1,060	1,240	950	700	365	220	205	....
17	1,120	1,160	....	1,430	1,060	1,180	950	850	365	220	205	....
18	1,150	1,160	1,110	1,430	900	1,180	900	700	350	220	190	260
19	1,170	1,290	....	1,430	860	1,120	850	680	340	220	190	....
20	1,220	1,240	....	1,390	1,000	1,090	800	660	310	240	190	....
21	1,220	1,240	....	1,340	1,000	1,060	750	640	310	220	260	....
22	1,270	1,240	....	1,290	1,060	1,090	775	620	310	220	190	....
23	1,320	1,240	....	1,240	1,060	1,120	800	620	285	220	190	....
24	1,320	1,210	....	1,300	1,160	1,150	850	620	285	220	190	....
25	1,040	1,210	....	1,300	1,150	1,180	850	850	285	190	190	310
26	1,030	1,200	1,430	1,240	1,140	1,320	900	800	285	190	190	....
27	1,030	1,190	1,450	1,180	1,120	1,360	950	660	260	175	187	....
28	940	1,190	1,250	1,180	1,140	1,360	900	620	285	220	184	....
29	1,210	1,190	1,290	1,180	....	1,360	850	620	285	190	186	....
30	1,210	1,250	1,340	1,240	....	1,330	800	620	285	260	188	338
31	1,210	....	1,330	1,240	....	1,300	....	580	....	310	190	....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 26, by deducting discharge determined for North and Swalley canals from that of Deschutes River at Bend; Nov. 27 to Dec. 12, from a fairly well defined rating curve; Dec. 26 to Sept. 30, from a rating curve well defined between 300 and 1,000 second-feet and fairly well defined outside of these limits. Discharge interpolated, taking into account changes in diversions, Dec. 27-31, May 3-7, 16-21, June 13-16, Aug. 9-14, and for periods of 1 to 3 days in February, March, and April, when recorder was not working properly.

Monthly discharge of Deschutes River below Bend, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	1,320	940	1,140	70,100	B.
November	1,290	930	1,160	69,000	B.
December	1,450	860	1,210	74,400	C.
January	1,500	1,180	1,380	84,800	C.
February	1,240	860	1,130	62,800	B.
March	1,360	1,060	1,220	75,000	C.
April	1,500	750	1,060	63,100	A.
May	850	580	683	42,000	A.
June	540	260	378	22,500	A.
July	398	175	238	14,600	B.
August	270	170	207	12,700	B.
September	338	190	277	16,500	C.
The year	1,500	170	839	608,000	

DESCHUTES RIVER AT TUMALO, OREG.

LOCATION.—In the NE. ¼ sec. 31, T. 16 S., R. 12 E., at the highway bridge in Tumalo, Deschutes County, 3 miles below Tumalo Creek, and 9 miles by river below Bend; below all important diversions.

DRAINAGE AREA.—Not measured.

y 1, 1909, to October 15, 1912; July 14 to October 11, 915, when station was discontinued. Records prior to

ank about 200 yards below old gage at highway bridge 1909 to 1914. Gage reader, W. R. Gerking.

Made from wagon bridge 1½ miles above gage in the 2 E.; fair section.

vel and boulders; fairly permanent.

ecords for 1915 cover neither maximum nor minimum. known at the station was in November, 1909, but the m practically the same as that at station below Bend. ge relation probably somewhat affected by ice in ex-

liversions from Deschutes River between this station . Practically the entire flow of Tumalo Creek is when there is ice or high water.

f power plant affects the flow at Tumalo considerably Bend. Results considered excellent.

hutes River at Tumalo, Oreg., during the year ending Sept. 30, 1915.

Made by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	3.21	1,360
	1.86	292
	1.91	303

Deschutes River at Tumalo, Oreg., for the year ending Sept. 30, 1915.

Day.	May.	June.	July.	Day.	May.	June.	July.
	511	......	......	21	632	300	......
	511	......	......	22	660	300	......
	625	......	......	23	......	284	......
	632	......	......	24	625	276	......
	632	......	......	25	618	272	......
	......	......	......	26	930	268	......
	930	......	......	27	920	......	......
	660	......	......	28	653	280	......
	910	300	......	29	625	260	......
	625	......	......	30	......	260	......
				31	618	......	305

vell-defined rating curve.

TES RIVER AT MECCA, OREG.

0, T. 9 S., R. 13 E., at bridge at Mecca station on fferson County, 1½ miles below mouth of Shitike outh of Warm Spring River.

l.

911, to September 30, 1915.

o tree on right bank, 75 feet above bridge. Gage

ade from highway bridge.

and gravel; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.20 feet at noon April 3 (discharge, 7,470 second-feet); minimum stage recorded, 1.95 feet in August and September (discharge, 3,410 second-feet).

1911–1915: Maximum stage recorded, 5.2 feet April 13, 1913 (discharge, 9,410 second-feet); minimum stage recorded, 1.95 feet in August and September, 1915 (discharge, 3,410 second-feet).

WINTER FLOW.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Flow affected by same diversions from upper Deschutes River as Bend, Tumalo, and Cline Falls stations. Summer flow of Crooked River above head of lower canyon near Terrebonne and also that of Squaw Creek, practically all diverted.

REGULATION.—None.

ACCURACY.—Results considered excellent.

Discharge measurements of Deschutes River at Mecca, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 25	P. V. Hodges	2.76	4,680	June 28	C. L. Batchelder	2.12	3,630
June 5	C. L. Batchelder	2.36	4,080	Sept 4	.....do	1.95	3,410

Daily discharge, in second-feet, of Deschutes River at Mecca, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,560	4,740	4,740	4,560	4,560	4,740	6,850	4,380	4,050	3,610	3,470	3,470
2	4,740	4,740	4,740	4,740	4,560	4,740	7,050	4,380	4,050	3,470	3,470	3,470
3	4,560	4,740	4,920	4,740	4,560	4,740	7,470	4,380	4,050	3,610	3,470	3,470
4	4,560	4,740	5,100	4,740	4,740	4,740	7,050	4,380	4,050	3,610	3,750	3,470
5	4,380	4,740	4,740	4,740	4,740	4,740	6,650	4,380	4,050	3,750	3,610	3,470
6	4,560	4,740	4,740	4,740	4,740	4,740	6,250	4,210	4,050	3,750	3,610	3,470
7	4,740	4,560	4,740	4,920	4,560	4,740	6,250	4,210	4,050	3,750	3,470	3,470
8	4,560	4,560	4,740	4,740	4,560	4,740	5,860	4,210	3,900	3,750	3,470	3,470
9	4,380	4,740	4,740	4,740	4,380	4,740	5,860	4,210	3,750	3,750	3,610	3,470
10	4,380	4,740	4,560	4,740	4,380	4,740	5,860	4,380	3,750	3,610	3,610	3,470
11	4,380	4,560	4,560	4,740	4,380	4,740	5,670	4,380	3,750	3,610	3,470	3,470
12	4,380	4,380	4,560	4,740	4,380	4,740	5,860	4,380	3,750	3,610	3,470	3,470
13	4,560	4,740	4,380	4,740	4,380	4,740	5,860	4,380	3,750	3,750	3,470	3,470
14	4,560	4,560	4,380	4,740	4,380	4,920	5,480	4,380	3,750	3,750	3,470	3,610
15	4,560	4,740	4,500	4,920	4,380	5,100	5,480	4,380	3,750	3,750	3,470	3,610
16	4,560	4,740	4,380	4,740.	4,380	5.480	5,100	4,560	3,750	3,610	3,470	3,750
17	4,560	4,740	4,380	4,740	4,380	5,480	5,100	4,740	3,750	3,610	3,470	3,750
18	4,740	4,740	4,380	4,740	4,560	5,480	5,100	4,740	3,750	3,610	3,470	3,750
19	4,740	4,740	4,380	4,740	4,380	5,290	4,920	4,560	3,750	3,470	3,470	3,750
20	4,740	4,740	4,380	4,740	4,380	5,100	4,740	4,380	3,750	3,470	3,470	3,750
21	4,740	4,740	4,380	4,740	4.560	5,290	4,740	4,380	3,750	3,470	3,470	3,750
22	4,740	4,740	4,210	4,560	4,560	5,480	4,740	4,380	3,750	3,470	3,470	3,750
23	4,740	4,740	4,380	4,560	4,560	5.480	4,740	4,380	3,750	3,470	3,470	3,610
24	4,740	4,740	4,380	4,380	4,740	5,860	4,740	4,380	3,750	3,470	3,470	3,610
25	4,740	4,740	4,740	4,380	4,740	6,050	4,740	4,210	3,750	3,470	3,470	3,610
26	4,560	4,740	4,740	4,380	4,740	6,050	4,560	4,380	3,750	3,470	3,470	3,610
27	4,560	4,740	4,740	4,380	4,740	5,860	4,560	4,380	3,750	3,470	3,470	3,610
28	4,380	4,740	4,740	4,380	4,740	5,670	4,380	4,380	3,610	3,470	3,470	3,610
29	4,560	4,740	4,560	4.380	......	6,250	4.380	4,380	3,610	3,470	3,470	3,610
30	4,740	4,740	4,560	4,380	......	7,260	4,390	4,380	3.470	3,470	3,470	3,610
31	4,740	......	4,560	4,380	......	6,850	......	4,210	......	3,470	3,470	......

NOTE.—Discharge determined from a well-defined rating curve.

ca, Oreg., for the year ending Sept. 30, 1915.

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
Maximum.	Minimum.	Mean.		
4,740	4,380	4,590	282,000	A.
4,740	4,380	4,700	280,000	A.
5,100	4,210	4,580	282,000	A.
4,920	4,380	4,640	285,000	A.
4,740	4,380	4,540	252,000	A.
7,260	4,740	5,310	326,000	B.
7,470	4,380	5,480	326,000	B.
4,740	4,210	4,380	269,000	A.
4,050	3,470	3,810	227,000	A.
3,750	3,470	3,580	220,000	A.
3,750	3,470	3,500	215,000	A.
3,750	3,470	3,580	213,000	A.
7,470	3,470	4,390	3,180,000	

March, 1914, should be rated C, and April, 1914, B. This
hs in Water-Supply Papers 362-C and 394.

MOODY, NEAR BIGGS, OREG.

N., R. 15 E., opposite Moody railroad station,
on-Washington Railroad & Navigation Co., 1½
about 5 miles southwest of Biggs, Sherman

miles.

to September 30, 1915; October 19, 1897, to
ear Moro, 10 miles above mouth of river in the
ecords for 1908 and 1910 somewhat fragmentary.
er inclined, the upper vertical. Gage reader,
on gage was an inclined staff.

from a cable about 450 feet above gage. At
e bridge" 3 miles below gage.

gravel; shifting only in floods.

n stage recorded during year, 3.7 feet afternoon
l-feet); minimum stage recorded, 1.9 feet August
3,600 second-feet).

corded, 7.50 feet February 6, 1907 (discharge,
tage recorded, 1.9 feet August 18 to September
.

tion never affected by ice.

this station has been progressively reduced since
from the upper river. Some of this water returns
idsummer is now probably 15 to 20 per cent.

cellent.

s River at Moody, near Biggs, Oreg., during the
nding Sept. 30, 1915.

Discharge.	Date.	Made by—	Gage height.	Discharge.
Sec.-ft.			*Feet.*	*Sec.-ft.*
5,290	Mar. 6	C. G. Paulsen..........	2.62	5,720
5,200	Aug. 29	P. V. Hodges...........	1.90	3,680
6,020				

Daily discharge, in second-feet, of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,720	5,320	5,020	5,020	5,020	5,960	9,400	5,020	5,020	3,920	3,920	3,680
2	4,720	5,320	5,020	5,020	5,020	5,960	9,400	5,020	5,020	3,920	3,920	3,680
3	4,720	5,320	5,020	5,020	5,020	5,960	9,400	5,020	4,720	3,920	3,920	3,680
4	4,720	5,320	5,020	5,020	5,020	5,960	9,850	5,020	4,720	3,920	3,920	3,680
5	4,720	5,320	5,020	5,020	5,320	5,960	9,400	5,020	4,720	3,920	3,920	3,680
6	4,720	5,320	4,720	5,020	5,320	5,630	8,600	5,020	4,440	3,920	3,920	3,680
7	4,720	5,320	4,720	5,020	5,320	5,630	8,600	5,020	4,440	3,920	3,920	3,680
8	4,720	5,320	4,720	5,020	5,020	5,630	8,200	5,020	4,440	3,920	3,920	3,680
9	4,720	5,320	5,020	5,020	5,020	5,630	7,800	5,020	4,440	3,920	3,920	3,680
10	4,720	5,320	5,020	5,020	5,020	5,630	7,800	5,020	4,440	3,920	3,920	3,680
11	4,720	5,320	5,020	5,020	5,020	5,630	7,400	5,020	4,440	3,920	3,920	3,680
12	4,720	5,020	5,020	5,020	5,020	5,630	7,000	5,020	4,440	3,920	3,920	3,680
13	4,720	5,020	5,020	5,020	5,020	5,630	7,000	5,320	4,440	3,920	3,920	3,680
14	4,720	5,020	4,720	5,020	5,020	5,630	6,650	5,320	4,440	3,920	3,920	3,680
15	5,020	5,020	4,720	5,320	5,020	5,960	6,300	5,320	4,440	3,920	3,920	3,680
16	5,020	5,020	4,440	5,320	5,020	6,650	6,300	5,320	4,440	3,920	3,920	3,680
17	5,020	5,320	4,440	5,320	5,020	6,650	6,300	5,320	4,440	3,920	3,920	3,920
18	5,020	5,320	4,440	5,020	5,020	6,650	6,300	5,320	4,440	3,920	3,680	3,920
19	5,020	5,320	4,440	5,020	5,020	6,650	6,300	5,020	4,440	3,920	3,680	3,920
20	5,020	5,320	4,440	5,020	5,020	6,650	5,960	5,020	4,440	3,920	3,680	3,920
21	5,020	5,320	4,440	5,020	5,020	6,650	5,960	5,020	4,440	3,920	3,680	3,920
22	5,020	5,320	4,720	5,020	5,020	6,650	5,960	5,020	4,440	3,920	3,680	3,920
23	5,020	5,320	4,720	5,020	5,320	6,650	5,630	5,020	4,180	3,920	3,680	3,920
24	5,320	5,320	4,720	5,020	5,960	7,000	5,630	5,020	4,180	3,920	3,680	3,920
25	5,320	5,320	5,020	5,020	7,000	7,000	5,630	5,020	4,180	3,920	3,680	3,920
26	5,320	5,320	5,020	5,020	6,650	7,000	5,630	5,020	3,920	3,920	3,680	3,920
27	5,320	5,320	5,020	5,020	6,300	7,000	5,630	5,020	3,920	3,920	3,680	3,920
28	5,320	5,320	5,020	5,020	5,960	7,000	5,630	5,020	3,920	3,920	3,680	3,920
29	5,320	5,320	5,020	5.020	....	7,000	5,320	5,020	3,920	3,920	3,680	3,920
30	5,320	5,020	5,020	5,020	....	7,400	5,320	5,020	3,920	3,920	3,680	3,920
31	5,320	....	5,020	5,020	....	9,400	....	5,020	....	3,920	3,680	....

NOTE.—Discharge determined from a well-defined rating curve.

Monthly discharge of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	5,320	4,720	4,960	305,000	A.
November	5,320	5,020	5,260	313,000	A.
December	5,020	4,440	4,830	297,000	A.
January	5,320	5,020	5,050	311,000	A.
February	7,000	5,020	5,300	294,000	A.
March	9,400	5,630	6,400	394,000	A.
April	9,850	5,320	7,010	417,000	A.
May	5,320	5,020	5,080	312,000	A.
June	5,020	3,920	4,390	261,000	A.
July	3,920	3,920	3,920	241,000	A.
August	3,920	3,680	3,810	234,000	A.
September	3,920	3,680	3,790	226,000	A.
The year	9,850	3,680	4,980	3,600,000	

EAST FORK AT MORSON'S INTAKE, NEAR LAPINE, OREG.

LOCATION.—In the NE. ¼ sec. 34, T. 23 S., R. 9 E., at private road bridge about half a mile from river road to Crescent, and 12 miles southwest of Lapine, Deschutes County. Up to July 27, 1915, in the SE. ¼ sec. 33, T. 23 S., R. 9 E., about 500 feet below the mouth of Crescent Creek, and above the proposed intake for the Deschutes Land Co., Carey Act segregation.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 26 to November 21, 1914; March 15 to September 30, 1915.

bridge since July 27, 1915; at old location,
ust 12 to November 21, 1914, and vertical
der, George M. Mayfield.
vading or from bridge.
l of gravel and sand, with steep banks of
t in floods. Channel divided by an island

stage recorded during period March 15 to
m. April 3 (discharge, 233 second-feet); min-
new gage September 3 to 11 (discharge, 40

d, 5.40 feet April 3, 1914 (discharge, 384
, 1909, may have reached 1,800 second-feet
nch). Minimum for 1915 was lowest in years.
three months; no winter records have been

t above the station.

March to May, for which time they are only
records.

*Morson's intake, near Lapine, Oreg., during the
g Sept. 30, 1915.*

y—	Gage height.	Dis-charge.
	Feet.	*Sec.-ft.*
	a 4.73	108
	b 3.91	68.1

e. b Gage height 0.70 foot on new gage.

*Fork at Morson's intake, near Lapine, Oreg., for
ing Sept. 30, 1915.*

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
						44
			144		74	
	233			85		40
		154			70	
	217		135			40
				85	63	
						40
		144	126		60	
	184					40
					58	
		174				40
	184		117	81	58	
						48
					56	
122		164	108			46
	184				58	
						46
135		164			56	
	217		95	72		42
					53	
						42
		144			50	
160	206					42
				62	48	
		160	92			42
	206				46	
164	184			67		42
	164		89		44	
		148		74		42
174	184				44	
				74		

s on old gage and a well-defined rating curve, Mar. 15 to July
ned rating curve July 29 to September 29; given only for days

Monthly discharge of East Fork at Morson's intake, near Lapine, Oreg., for the year ending Sept. 30, 1915.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
March 15-31	151	4,790	C.	August	55.9	3,440	B.
April	197	11,700	C.	September	42.4	2,520	B.
May	156	9,590	C.				
June	113	6,720	B.	The period	110	43,400	
July	75.0	4,610	B.				

Note.—Monthly mean is average of discharge determined for days on which gage was read.

EAST FORK AT ALLEN'S RANCH, NEAR LAVA, OREG.

Location.—In the SW. ¼ SW. ¼ sec. 8, T. 20 S., R. 11 E., on C. B. Allen's ranch, about a mile above mouth of East Fork and about a mile north of former post office of Lava, Oreg., 18 miles south of Bend, Deschutes County.

Drainage area.—About 720 square miles.

Records available.—February 17, 1905, to May 4, 1912; May 27, 1913, to September 30, 1915, when station was discontinued.

Gage.—Inclined staff on east bank of river; datum since January 1, 1912, 0.10 foot higher than previously. Gage reader, Mrs. C. B. Allen.

Discharge measurements.—Made from bridge about 200 feet below gage.

Channel and control.—Sand and clay; somewhat shifting; stage-discharge relation may be affected by growth of aquatic plants or by backwater from Deschutes River.

Extremes of discharge.—Maximum stage recorded during year, 6.10 feet at 12 noon, April 5 (discharge, 303 second-feet); minimum stage recorded, 4.50 feet August 29 to September 11 and September 20 to 30 (discharge, 43 second-feet).

1905–1915: Maximum stage recorded, 11.1 feet November 25, 1909 (discharge, 2,150 second-feet): minimum stage recorded, 4.50 feet August 29 to September 11 and September 20 to 30, 1915 (discharge, 43 second-feet).

Winter flow.—Stage-discharge relation seriously affected by ice.

Diversions.—A considerable area, in small tracts, is irrigated above the station.

Regulation.—None.

Accuracy.—Results for 1915 considered good; those for earlier years, fair.

Discharge measurements of East Fork at Allen's ranch, near Lava, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Nov. 3	James E. Stewart	5.56	148	May 2	Mrs. C. B. Allen	5.75	246
Dec. 17	do	5.67	88.5	17	do	5.75	241
Jan. 9	Mrs. C. B. Allen	5.55	98.7	30	do	5.70	223
17	do	5.80	92.7	June 13	do	5.51	175
22	do	5.75	106	27	do	5.19	124
Feb. 1	C. G. Paulsen	5.95	114	July 11	do	5.15	107
6	Mrs. C. B. Allen	6.10	120	25	do	4.80	74.7
15	do	6.15	139	29	P. V. Hodges	4.85	76.8
18	J. E. Stewart	6.21	131	Aug. 8	Mrs. C. B. Allen	4.75	60.9
Mar. 1	do	5.90	149	22	do	4.60	48.7
10	P. V. Hodges	5.35	172	Sept. 5	do	4.50	43.4
21	Mrs. C. B. Allen	5.45	195	21	do	4.51	47.6
Apr. 4	do	6.05	291	Oct. 1	Henshaw and Batchelder	4.55	44.5
18	do	5.80	245				

Note.—Stage-discharge relation affected by ice for measurements Dec. 17 to Mar. 1.

of East Fork at Allen's ranch, near Lava, Oreg., for the year ending Sept. 30, 1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
99	114	149	247	238	248	106	80	43
99	115	169	256	238	236	106	80	43
99	115	184	284	247	223	106	74	43
99	115	200	294	247	223	106	74	43
99	115	218	303	256	210	113	69	43
99	120	192	294	230	198	113	69	43
99	127	199	284	222	186	120	69	43
99	134	184	284	222	175	120	64	43
99	134	170	274	222	175	120	64	43
99	134	170	256	214	186	113	64	43
99	134	170	247	214	175	113	64	43
99	134	170	147	230	175	106	59	46
99	140	177	256	247	175	99	59	46
99	140	184	265	265	175	92	59	50
99	139	184	265	230	175	92	59	50
94	134	184	256	238	164	92	54	50
93	134	192	256	238	164	92	54	50
94	131	199	247	238	154	92	54	46
94	134	199	247	230	145	86	54	46
94	134	192	247	210	145	80	50	43
99	134	192	256	210	128	80	50	43
106	134	192	256	210	120	80	50	43
104	134	199	265	210	120	74	50	43
99	134	206	274	236	120	74	50	43
99	134	214	284	248	120	69	50	43
99	134	222	265	260	120	69	50	43
104	140	222	256	248	120	69	46	43
110	147	214	247	236	120	69	46	43
115	....	214	238	236	113	74	43	43
115	....	230	230	223	103	80	43	43
115	....	256	....	236	....	80	43	....

ows: Oct. 1–20, from a fairly well defined rating curve; Oct. 21–24 Oct. 25 to Nov. 29, from a fairly well defined rating curve; Nov easurements, observer's notes, and records of temperature (stage 6 to May 19, from a well-defined rating curve; May 20 to Sept. 30

t Allen's ranch, near Lava, Oreg., for the year ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
	200	95	129	7,930	C.
	154	115	133	7,910	B.
	110	88	101	6,210	C.
	115	93	101	6,210	B.
	147	114	131	7,280	B.
	256	149	195	12,000	B.
	303	230	263	15,600	A.
	265	210	233	14,300	A.
	248	106	163	9,700	A.
	120	69	93.1	5,700	A.
	80	43	57.9	3,560	A.
	50	43	44.3	2,640	B.
	303	43	137	99,100	

OF CRESCENT LAKE, NEAR CRESCENT, OREG.

. 6 E., at lake outlet, about 16 miles from Crescent,

to September 6, 1911; January 1, 1912, to July 31, inued.

Gage.—Vertical staff on left bank. Gage reader, David Lynes. During 1911 a vertical staff gage was maintained by the Hunter Land Co. No determined relation between datum of 1911 and that maintained from 1912 to 1915.

Discharge measurements.—Made by wading near the gage.

Channel and control.—Gravel; not likely to shift; some drift logs jammed at gage section at lake.

Extremes of discharge.—Maximum stage recorded during year, 1.10 feet May 14 and June 5 to 26 (discharge, 61 second-feet). Records of minimum stage August to October are not available.

1911–1915: Maximum stage recorded, 1.70 feet June 9 and 13, 1912 (discharge, 181 second-feet); peak may have been higher, as gage was read only occasionally. A measurement made July 22, 1904, gave 195 second-feet, and the maximum that year was probably at least 250 or 300 second-feet.

Winter flow.—Stage-discharge relation probably unaffected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results fair.

Discharge measurements of Crescent Creek at outlet of Crescent Lake, near Crescent, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 26	J. E. Stewart	0.86	29.6
July 26	P. V. Hodges	.65	19.8

Daily discharge, in second-feet, of Crescent Creek at outlet of Crescent Lake, near Crescent, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1										
2	35									
3				27						
4										
5			35			31			61	
6	35	41			27					47
7							29	41		
8										
9										
10				27						35
11		41								
12					27				61	
13										
14	35		31			31		61		
15							31			
16										31
17										
18				27						
19		35			29		35	58	61	
20						31				
21			31							
22										
23	35			27						
24		35								
25								58		
26					32				61	20
27										
28		35		27	31	31				
29			31							
30	35						35			
31								58		

Note.—Discharge determined from a fairly well-defined rating curve; given only for days on which gage was read.

eek at outlet of Crescent Lake, near Crescent, Oreg., for ear ending Sept. 30, 1915.

off in et).	Accuracy.	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
150	B.	April	32.5	1,930	B.
230	B.	May	55.2	3,390	B.
970	B.	June	61.0	3,630	B.
660	B.	July	33.2	2,040	B.
620	B.				
910	B.	The period		22,500	

leterminations of discharge for days on which gage was read.

CANAL NEAR BEND, OREG.

3, T. 18 S., R. 11 E., about a mile below intake of
end, Deschutes County.

1914, to September 30, 1915; information sufficient
, 1912, to March, 1914.

flume. A gage one-half mile above, in the NE.
pril 30, 1915. O. C. Bowman and Joe Stenkamp,

de from collar of flume near gage.

12 feet wide; gradient fairly steep.

mum stage recorded during year, 2.20 feet August
l-feet). This is greatest flow ever diverted. Ditch
year.

ood.

n the right bank of Deschutes River at the head of
T. 18 S., R. 11 E., and irrigates land south and east
egon Irrigation Co.'s Carey Act segregation. There
he old and new stations. The latter is at the point
the river.

Canal near Bend, Oreg., during the year ending Sept. 30, 1915.

Discharge.	Date.	Made by—	Gage height.	Discharge.
Sec.-ft.			*Feet.*	*Sec.-ft.*
45.4	Sept. 29	Henshaw and Batchelder	2.05	88.7
97.9	29	do	[a]1.92	88.0
111.0				
	1916. Feb. 21	P. V. Hodges	1.30	38.9

gage one-half mile below former gage.

Daily discharge, in second-feet, of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	0	35	30	0	0	37	0	66	92	108	104
2	52	21	35	30	0	0	37	36	66	92	108	104
3	52	21	35	30	0	0	37	36	66	92	108	104
4	52	21	35	30	0	0	37	38	66	92	108	90
5	0	46	35	0	0	0	37	38	70	92	108	100
6	0	46	35	0	0	0	37	38	73	92	108	104
7	0	46	35	0	0	0	37	38	73	96	108	88
8	0	46	0	0	0	0	37	48	80	96	108	88
9	0	46	0	0	0	0	37	48	80	96	108	88
10	0	23	0	0	0	0	37	48	80	96	108	88
11	0	0	0	0	0	0	48	48	80	92	112	88
12	0	0	0	0	0	0	48	54	80	92	112	88
13	0	0	0	0	40	0	48	54	80	92	112	76
14	0	0	0	0	40	0	48	54	80	92	112	66
15	0	0	0	0	40	0	48	54	80	92	96	66
16	0	0	0	0	20	0	48	43	80	92	96	73
17	0	0	0	0	0	12	48	48	80	92	96	80
18	0	0	0	0	0	23	48	48	80	92	96	88
19	0	0	0	0	0	25	48	48	80	96	104	92
20	0	0	0	0	0	30	48	48	84	96	104	92
21	0	0	0	0	0	32	48	60	84	108	104	92
22	0	0	0	0	0	32	48	66	84	108	104	88
23	0	0	0	0	0	32	48	66	84	108	104	92
24	0	35	0	0	0	32	48	66	84	108	96	92
25	0	35	0	0	21	32	0	66	84	104	96	92
26	0	35	0	0	21	32	0	66	84	104	96	92
27	0	35	0	0	0	34	0	66	84	104	96	92
28	0	35	30	0	0	37	0	66	84	104	96	92
29	0	35	30	0	0	37	10	66	88	108	96	92
30	0	35	30	0	......	37	4	66	88	108	96	88
31	0	......	30	0	......	37	......	66	......	108	104	......

NOTE.—Discharge determined from rating curves as follows: Oct. 1 to Mar. 16, well defined; Mar. 17 to Apr. 30, fairly well defined; May 1 to Sept. 30, well defined.

Monthly discharge of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	52	0	6.7	412	B.
November	46	0	18.7	1,110	B.
December	35	0	11.8	726	B.
January	30	0	3.9	240	B.
February	40	0	6.5	361	B.
March	37	0	15.0	922	B.
April	48	0	35.2	2,090	B.
May	66	0	51.2	3,150	B.
June	88	66	79.1	4,710	A.
July	108	92	97.9	6,020	A.
August	112	96	103	6,330	A.
September	104	66	89.3	5,310	A.
The year	112	0	43.4	31,400	

CENTRAL OREGON CANAL NEAR BEND, OREG.

LOCATION.—In the NE. ¼ sec. 7, T. 18 S., R. 12 E., at a flume section about half a mile below point where waters in main diversion canal are divided between this canal and the Pilot Butte canal; about 2 miles south of Bend, Deschutes County.

RECORDS AVAILABLE.—May 11, 1905, to September 30, 1915.

GAGE.—Vertical enameled staff nailed to inside of flume on right side. Gage reader, N. P. Vinyard.

DISCHARGE MEASUREMENTS.—Made from yoke of flume at gage section.

of rectangular cross section with battened
e rating appears not to change.

ge recorded during year, 3.5 feet July 5 to
r 1 to 7 (discharge, 341 second-feet). This
, but was equaled August 18, 1914. Canal

, but only during periods of moderate cold,
. The fall through the section at the gage
l at all times.

y Central Oregon Irrigation Co.

m the right bank of Deschutes River in the
rigates land lying to the east of Bend and in

canal near Bend, Oreg., during the year ending
30, 1915.

e.	Date.	Made by—	Gage height.	Dis-charge.
ft.			*Feet.*	*Sec.-ft.*
66	Aug. 1	P. V. Hodges..........	3.50	341
14	Sept. 29	Henshaw and Batchelder....................	2.98	266
09				

l Oregon canal near Bend, Oreg., for the year
Sept. 30, 1915.

eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
0	0	0	272	272	327	341	341
0	0	0	246	285	272	341	341
0	0	0	259	285	327	341	341
0	0	0	272	285	327	341	341
0	0	0	272	299	341	341	341
0	0	0	272	313	341	341	341
0	0	0	272	327	341	341	341
0	0	0	285	327	341	341	327
0	0	0	299	327	341	341	327
0	0	37	299	327	341	341	327
0	11	118	299	327	327	341	327
0	22	152	299	327	327	341	299
0	27	158	313	327	327	341	299
0	32	158	299	327	327	341	299
0	0	158	299	134	327	327	299
0	0	158	299	313	341	341	299
0	49	158	272	327	341	341	285
67	49	182	220	327	341	341	272
134	123	194	220	327	341	341	272
0	123	220	246	327	341	341	272
134	146	246	246	327	341	341	272
134	73	246	246	327	341	341	272
134	0	246	246	327	341	341	272
25	0	246	246	327	341	341	272
12	0	233	246	327	341	341	272
12	0	233	246	327	341	341	272
6	0	233	246	327	341	341	272
0	0	246	246	327	341	341	272
......	0	272	259	327	341	341	272
......	0	272	272	341	327	341	272
......	0	......	272	......	313	327	......

-defined rating curve.

Monthly discharge of Central Oregon canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	200	0	34.1	2,100	D.
November	170	0	14.2	845	D.
December	170	0	25.2	1,550	D.
January	152	0	9.8	603	D.
February	134	0	23.5	1,310	C.
March	146	0	21.1	1,300	C.
April	272	0	139	8,270	B.
May	313	220	267	16,400	B.
June	341	134	313	18,600	A.
July	341	272	334	20,500	A.
August	341	327	340	20,900	A.
September	341	272	300	17,900	A.
The year	341	0	152	110,000	[illegible]

PILOT BUTTE CANAL NEAR BEND, OREG.

Location.—In the NE. ¼ sec. 7, T. 18 S., R. 12 E., at a point in the canal directly opposite gaging station on Central Oregon canal, half a mile below the point where the waters are divided between this canal and the Central Oregon canal, and about 2 miles south of Bend, Deschutes County.

Records available.—March 6, 1905, to September 30, 1915.

Gage.—Vertical staff on right bank. Gage reader, N. P. Vinyard.

Discharge measurements.—Made by wading at the gage or from a highway bridge half a mile below the gage.

Channel and control.—Channel, gravel and sand; control partly solid rock; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 1.95 feet July 15 to 29 and August 6 to September 11 (discharge, 56 second-feet); canal dry at various times.

1905–1915: Maximum stage recorded, 3.10 feet June 8, 11 to 16, July 19 to 21, 1913 (discharge, 244 second-feet).

Winter flow.—Canal operated intermittently during ice season to provide water for stock and domestic use. Stage-discharge relation not affected by ice.

Accuracy.—Results good.

Pilot Butte canal diverts water from the left bank of Deschutes River, in the NE. ¼ sec. 13, T. 18 S., R. 12 E., in a flume common to it and the Central Oregon canal, for irrigating lands lying mostly north of Bend and extending nearly to Crooked River. North canal also diverts water into the Pilot Butte.

Discharge measurements of Pilot Butte canal near Bend, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 19	F. F. Henshaw	1.87	48.8
Sept. 29	Henshaw and Batchelder	1.71	35.2

Butte canal near Bend, Oreg., for the year ending
pt. 30, 1915.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
0	0	0	27	34	51	42	56
0	0	0	27	34	44	42	56
0	0	0	27	34	51	42	56
0	27	0	27	34	51	42	56
0	27	0	27	38	51	49	56
0	27	0	34	46	51	56	56
0	14	0	34	46	51	56	56
0	0	0	34	46	44	56	56
0	0	0	34	46	38	56	56
0	0	4	34	46	38	56	56
0	0	15	34	42	38	56	56
0	0	24	34	49	38	56	51
0	0	24	34	51	36	56	51
0	0	12	34	51	40	56	51
0	0	0	34	44	56	56	51
0	0	9	34	49	56	56	51
0	0	24	34	51	56	56	42
14	0	27	30	51	56	56	34
27	0	27	28	51	56	56	34
27	10	27	30	51	56	56	34
14	24	27	30	51	56	56	34
0	12	27	33	51	56	56	34
0	0	27	34	51	56	56	34
0	0	27	34	51	56	56	34
0	0	27	34	51	56	56	34
0	0	27	30	51	56	56	34
0	0	27	34	51	56	56	34
0	0	27	34	51	56	56	34
.....	0	27	33	51	56	56	34
.....	0	27	34	51	46	56	34
.....	0	....	34	....	42	56	....

rve well defined between 15 and 60 second-feet.

ar Bend, Oreg., for the year ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
..	21	0	4.2	258	D.
..	36	0	3.9	232	D.
..	27	0	0.9	55	D.
..	27	0	3.1	191	D.
..	27	0	2.9	161	D.
..	27	0	4.5	277	D.
..	27	0	15.4	916	B.
..	34	27	32.1	1,970	A.
..	51	34	46.8	2,780	A.
..	56	36	50.0	3,070	A.
..	56	42	54.0	3,320	A.
..	56	34	45.2	2,690	A.
..	56	0	22.0	15,900	

NEAR BEND, OREG.

S., R. 13 E., about 500 feet below bridge on
low intake, and about a mile north of Bend,

September 30, 1915.
lining of flume. Gage reader, C. Orewiler.
n plank across canal.

Channel and control.—Concrete lined section extends about 1,000 feet below gage; below this point the canal is unlined and sides and bottom are very rough. Changes in unlined section may affect stage-discharge relation.

Extremes of discharge.—Maximum stage recorded during year, 5.95 feet July 24 to 29 (discharge, 300 second-feet). Canal dry at various times.

1913–1915: Maximum discharge recorded, 304 second-feet (gage height, 5.85 feet) August 7 to 18, 1914.

Winter flow.—Only a small quantity of water diverted in winter for stock; stage-discharge relation not affected by ice.

Accuracy.—Results considered good.

North canal diverts water from the right bank of Deschutes River at a concrete dam about 60 feet high, in the NE. ¼ sec. 29, T. 17 S., R. 13 E., and extends eastward for about a mile, where it discharges the water into Pilot Butte canal.

Discharge measurements of North canal near Bend, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 18	F. F. Henshaw	3.88	153	Sept. 30	Henshaw and Batchelder	5.20	237
22	.....do	4.56	201	30	.....do	3.10	106
June 17	.....do	5.81	303	30	.....do	1.20	28.6
20	.....do	5.89	294				

Daily discharge, in second-feet, of North canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	168	118	0	68	0		0	245	245	296	296	296
2	182	118	0	0	0	0	0	224	259	296	296	296
3	182	148	0	0	0	51	0	259	259	296	296	296
4	175	148	54	0	0	102	0	252	266	296	296	296
5	175	130	107	0	0	102	0	245	273	296	296	296
6	175	130	54	0	0	0	0	245	288	296	296	296
7	175	130	0	0	0	0	0	245	288	296	296	296
8	175	130	0	0	0	0	0	245	288	296	296	288
9	175	130	0	0	0	0	0	245	288	296	296	273
10	175	130	0	0	0	0	0	245	288	296	296	273
11	175	130	0	0	0	0	92	245	288	296	296	238
12	175	130	0	0	0	0	102	259	288	296	296	238
13	175	130	0	0	0	0	102	259	288	296	296	238
14	175	130	0	0	0	0	112	259	288	296	296	231
15	175	130	0	0	17	0	142	259	288	296	296	224
16	175	130	0	0	16	0	142	259	288	296	296	224
17	175	130	0	0	16	0	154	119	288	296	296	217
18	175	130	0	0	30	0	154	245	288	296	296	217
19	175	0	16	12	64	0	154	252	296	296	296	217
20	175	0	16	0	72	0	161	252	296	296	296	217
21	175	0	0	0	82	0	189	252	296	296	296	231
22	175	0	0	0	102	59	203	252	296	296	296	231
23	77	0	0	0	0	112	203	252	296	296	296	245
24	77	0	0	0	0	130	203	252	296	304	296	245
25	77	0	0	0	0	130	203	252	296	304	296	245
26	82	0	0	30	0	0	203	126	296	304	296	245
27	82	0	0	60	0	0	203	116	296	304	296	245
28	82	0	0	60	0	0	217	231	296	304	296	245
29	82	0	0	0	0	0	217	231	296	304	296	245
30	82	0	28	0	......	0	238	231	296	288	296	245
31	82	......	64	0	......	0	......	238	......	280	296	......

Note.—Discharge determined from a well-defined rating curve.

.., *for the year ending Sept. 30, 1915.*

charge in second-feet.			Run-off (total in acre-feet).	Accuracy.
m.	Minimum.	Mean.		
82	77	148	9,100	A.
48	0	78.4	4,670	B.
07	0	10.9	670	D.
68	0	7.4	455	D.
02	0	14.2	789	D.
30	0	22.1	1,360	D.
238	0	113	6,720	B.
259	116	235	14,400	A.
296	245	287	17,100	A.
304	280	297	18,300	A.
296	296	296	18,200	A.
296	217	253	15,100	A.
304	0	147	107,000	

BEND, OREG.

E., about 100 yards above road cross- at North canal dam, and about 1½

er 30, 1915.

end of intake flume. Gage reader,

laid across flume.

cross section and practically perma-

corded during year, 2.1 feet August 7 second-feet). This is probably the dry at various times.

ank of Deschutes River at the North the Carey Act segregation of the Des- end and west of the Pilot Butte tract.

end, Oreg., during the year ending Sept.

te.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
e 20	F. F. Henshaw	1.92	75.5
. 30	C. L. Batchelder	1.80	65.6

Daily discharge, in second-feet, of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	43	38	14	6	5	23	28	43	57	80	18	66
2	38	38	14	19	5	2	28	38	57	80	46	87
3	38	38	14	28	5	2	28	38	57	80	80	87
4	38	38	14	28	5	2	28	38	57	80	80	87
5	38	38	14	28	5	2	28	38	57	80	80	80
6	38	38	14	28	5	12	28	38	60	80	80	80
7	38	38	14	28	5	33	28	38	60	80	80	80
8	38	38	14	28	5	38	28	38	60	80	80	73
9	38	38	14	28	5	38	28	38	60	80	80	73
10	38	38	14	28	5	38	28	0	63	80	40	73
11	38	38	14	23	5	38	28	57	66	80	0	73
12	38	38	14	18	5	38	28	57	66	40	23	73
13	38	38	14	18	5	38	28	57	66	12	80	73
14	38	38	2	18	5	38	28	57	66	48	73	73
15	38	38	2	18	5	28	28	57	66	80	73	73
16	38	38	2	18	18	28	28	57	66	76	46	73
17	38	38	2	18	18	23	45	48	66	80	23	73
18	38	38	2	23	18	18	45	54	66	80	73	73
19	38	38	0	23	18	28	43	63	80	80	73	73
20	38	38	0	23	18	28	43	60	80	80	73	73
21	38	38	0	23	20	28	43	57	80	80	0	73
22	38	38	0	23	23	23	43	57	80	80	73	73
23	38	38	0	23	23	23	43	57	80	80	73	73
24	38	38	0	23	23	28	43	57	80	80	73	73
25	38	38	0	23	23	28	43	57	80	80	73	73
26	38	38	0	23	23	28	43	57	80	80	73	73
27	38	38	0	23	23	28	43	57	80	80	87	73
28	38	38	0	23	23	0	43	57	80	0	87	73
29	38	38	0	23	....	0	43	57	80	60	87	73
30	38	14	0	23	....	0	43	57	80	40	87	73
31	38	....	6	5	....	0	....	57	....	0	66	....

NOTE.—Discharge determined from a well-defined rating curve.

Monthly discharge of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	43	38	38.2	2,350	A.
November	38	14	37.2	2,210	A.
December	14	0	6.4	394	B.
January	28	5	22.1	1,360	A.
February	23	5	12.4	689	B.
March	38	0	22.0	1,350	A.
April	45	28	35.1	2,090	A.
May	63	0	49.7	3,060	A.
June	80	57	69.2	4,120	A.
July	80	0	68.9	4,240	A.
August	87	0	63.9	3,930	A.
September	87	66	74.9	4,460	A.
The year	87	0	41.8	30,300	

END, OREG.

E., one-fourth mile above the diver-
project, half a mile below highway
outh and 4 miles northwest of Bend,

mber 30, 1915 (fragmentary). Until
vinter months only to insure a year-
is somewhat isolated and sometimes

ous water-stage recorder referred to
Staff gage read November, 1910, to
Previous records at different site.
, made by wading near the gage; at
tream about 200 yards blow gage.
t likely to shift greatly.
orded during year, 2.11 feet at mid-
tal, including diversions, 226 second-
at 6 p. m. September 18 (discharge,
44 second-feet).
feet at old gage November 14, 1906
g curve, 820 second-feet). The peak
bly considerably greater. Minimum

siderably affected by ice during

canals and Anderson ditch divert
measured June 18, at which time it
ch 4.6 second-feet. From informa-
project, an estimate of the monthly
een prepared (p. 61). Water was
ember 24 and turned out October 14,
eased about 18 second-feet; the mean
ed as 12 second-feet.

nd, Oreg., during the year ending Sept.

e.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*
18	F. F. Henshaw.........	1.60	110
. 9	Dubuis and Wallace...	1.20	45.5

affected by ice.

Daily discharge, in second-feet, of Tumalo Creek near Bend, Oreg., for the year endin Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	62	103	78	62	70	68	103	121	161	110	61	50
2	72	130	80	65	76	68	112	121	150	110	62	50
3	64	121	78	65	70	68	112	112	140	100	64	50
4	62	103	75	65	70	70	103	103	150	100	61	48
5	62	92	78	68	72	65	94	103	161	91	61	48
6	65	84	78	70	72	64	94	112	172	100	62	51
7	65	78	78	68	68	62	94	112	194	91	62	48
8	64	81	76	65	70	62	94	121	172	100	61	50
9	65	78	75	65	68	56	86	140	150	100	60	47
10	62	78	75	65	67	59	94	140	130	82	60	47
11	64	80	75	65	67	64	112	130	110	73	58	47
12	62	84	75	67	67	65	121	130	100	78	58	47
13	64	78	74	72	67	67	112	130	110	77	55	47
14	72	78	74	65	67	65	103	121	120	68	52	48
15	78	76	73	66	67	65	103	112	120	66	54	47
16	78	78	73	64	68	62	112	112	120	68	54	48
17	80	78	72	64	72	62	121	121	130	70	55	44
18	81	78	72	65	75	62	130	130	120	66	52	44
19	81	78	71	65	72	59	140	121	110	64	52	44
20	81	78	70	62	73	61	150	112	100	68	51	44
21	81	78	69	65	70	62	140	112	110	68	51	44
22	78	78	68	64	68	68	130	112	110	72	51	44
23	78	78	67	63	68	68	121	121	130	66	50	44
24	76	75	66	63	72	76	112	121	120	66	50	44
25	75	73	65	63	72	81	121	112	100	66	50	44
26	75	75	65	63	70	76	121	121	91	64	50	45
27	78	78	64	63	70	75	130	140	91	62	51	45
28	78	78	64	63	68	84	140	161	91	62	50	47
29	78	78	63	63	......	91	150	161	100	66	51	45
30	89	78	63	63	......	81	130	150	100	66	51	45
31	94	......	62	62	......	78	......	161	......	64	51	......

NOTE.—Discharge determined from well-defined rating curves applicable October 1 to May 31 and June 1 to September 30. Discharge interpolated, on account of ice, December 12–31 and January 23–30.

Monthly discharge of Tumalo Creek near Bend Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	94	62	73.0	4,490	A.
November	130	73	83.4	4,960	A.
December	80	62	71.5	4,400	B.
January	72	62	64.7	3,980	B.
February	76	67	69.9	3,880	A.
March	91	56	68.2	4,190	A.
April	150	86	116	6,900	A.
May	161	103	125	7,690	A.
June	194	91	125	7,440	A.
July	110	62	77.5	4,770	A.
August	64	50	55.2	3,390	A.
September	50	44	46.5	2,770	A.
The year	194	44	81.4	58,900	

ner canal, Columbia Southern canal, ng Sept. 30, 1915.

feet.				
n, ner h.	Mean, Anderson ditch.	Total.	Run-off, total in acre-feet.	Accuracy.
5.4	....	78.4	4,820	A.
.....	....	83.5	4,960	A.
.....	....	71.5	4,400	B.
.....	....	64.7	3,980	B.
.....	....	69.9	3,880	A.
.....	....	68.2	4,190	A.
.....	2.0	118	7,020	A.
.....	4.0	129	7,930	A.
5.0	5.0	135	8,030	B.
.....	3.0	80.5	4,950	A.
.....	3.0	58.2	3,580	A.
.....	2.5	49.0	2,920	A.
.....	....	83.3	60,600	

canal.

R BEND, OREG.

l E., in concrete-lined section about elow bridge across Tumalo Creek on Bend, Deschutes County.

ter was first diverted, to September

twice daily by J. C. Stiles.

bridge at gage.

section; the control is the sand

corded during period May 21, 1914, ne 7, 1915 (discharge, 182 second-feet).

xtremely cold weather.

Creek in the SE. ¼ sec. 23, T. 17 S., me land is also watered directly from

ar Bend, Oreg., during the year ending 15.

te.	Made by—	Gage height.	Dis charge.
		Feet.	*Sec. ft.*
29	C. G. Paulsen..........	a2.23	3.7
22	F. F. Henshaw........	3.08	120
18	.....do.................	3.00	108

affected by ice.

Daily discharge, in second-feet, of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	52	52	13	35	32	56	83	83	150	110	52	48
2	56	52	23	35	32	56	96	47	140	110	52	47
3	53	52	43	25	48	50	101	52	135	106	56	47
4	7.5	51	13	30	53	32	92	66	135	125	52	46
5	7.5	49	30	38	56	24	88	59	150	88	52	45
6	8.0	48	0	48	56	24	88	66	170	96	53	50
7	8.0	48	0	63	56	24	88	101	170	92	53	48
8	7.5	49	0	66	56	23	83	120	170	101	52	47
9	7.5	48	0	33	55	13	83	130	160	96	52	47
10	7.5	48	0	0	56	11	88	130	120	74	51	47
11	52	47	0	0	56	10	101	120	106	70	51	47
12	52	47	30	12	56	6	106	135	106	74	50	47
13	52	47	83	49	56	58	106	130	101	74	49	46
14	52	47	55	66	56	60	88	115	120	66	48	47
15	52	15	0	60	56	62	96	110	125	66	49	47
16	52	16	0	35	56	60	101	110	110	66	48	47
17	52	16	0	65	58	60	110	120	115	65	47	47
18	51	13	0	65	59	60	125	130	125	65	47	46
19	51	21	0	0	58	59	130	62	106	66	47	46
20	51	23	0	0	58	58	140	110	101	65	47	45
21	50	23	0	12	56	58	130	110	106	66	47	46
22	50	23	0	59	56	62	120	110	110	66	47	46
23	50	23	0	30	56	65	110	110	120	62	47	46
24	50	23	0	5	58	65	110	115	120	62	47	46
25	52	19	0	5	57	66	110	96	101	62	47	46
26	52	15	0	4	56	65	115	110	92	59	47	46
27	52	15	0	4	56	65	125	125	88	58	48	46
28	57	15	35	4	56	70	140	145	88	56	48	46
29	72	14	35	4	......	74	140	72	92	56	48	46
30	72	13	35	5	......	74	135	37	110	56	48	46
31	59	......	35	24	......	70	......	140	......	54	47	......

NOTE.—Discharge determined from a rating curve well defined between 8 and 140 second-feet. Discharge estimated, on account of ice, Dec. 28-31 and Jan. 17, 24-30.

Monthly discharge of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	72	7.5	43.5	2,670	B.
November	52	13	32.4	1,930	B.
December	83	0	13.9	855	C.
January	66	0	28.4	1,750	C.
February	59	32	54.3	3,020	A.
March	74	6	49.7	3,060	A.
April	140	83	108	6,430	A.
May	145	37	102	6,270	A.
June	170	88	121	7,200	A.
July	125	54	75.2	4,620	A.
August	53	47	49.3	3,030	B.
September	50	45	46.6	2,770	B.
The year	170	0	60.2	43,600	

ERS, OREG.

E., immediately above the intake
d above Sisters, Deschutes County.

13; April 7 to September 13, 1914;
906, to May 29, 1913, in section 20,
about 700 feet farther downstream.
rge Brewster, water master.
idge above gage, or by wading.

rded May 9 to September 2, 2.60
et); minimum stage recorded, 1.85

feet at old station November 22,
rating curve as 1,940 second-feet);
tion March 19, 1912 (discharge, 32

Creek from the west, has been di-
as been eroded until it carries the
irely diverted below the station.

high-water periods, for which they
tuation due to melting snow.

s, Oreg., during the year ending Sept.

	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*
4	G. H. Brewster........	2.24	127
28	Henshaw and Kennard	1.83	51.7

ear Sisters, Oreg., for the year ending
.

Day	May	June	July	Aug.
....	69	120	125	130
....	71	138	112	120
....	78	142	121	112
....	86	125	129	112
....	62	138	138	112
....	62	138	150	108
....	62	145	150	110
....	64	148	150	112
....	67	152	150	155
....	62	155	138	100
....	54	120	165	105
....	102	112	128	105
....	150	121	126	100
....	112	130	125	129
....	125	150	120	158
....	125	......	112	105

g curve. Discharge interpolated for days for
3, 27; June 9, 11, 12, 23, 24, 28; July 18, 19, 22,

Monthly discharge of Squaw Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 9-31	150	54	90.4	4,120
June	175	100	133	7,910
July	205	100	149	9,160
August	205	100	126	7,750
The period				28,900

OCHOCO CREEK AT ELLIOTT'S RANCH, NEAR PRINEVILLE, OREG.

Location. In the NE. ¼ sec. 5, T. 15 S., R. 17 E., at dam site of proposed reservoir for Ochoco project, below all tributaries; 6½ miles east of Prineville, Crook County, on road to Mitchell.

Drainage area.—300 square miles.

Records available.—November 1, 1908, to April 30, 1910, and November 23, 1914, to June 30, 1915.

Gage.—Vertical staff on left bank. Gage reader, David Elliott.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Gravel and boulders; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 2.4 feet at noon April 3 (discharge, 290 second-feet); minimum stage recorded, 0.59 foot October 26 (discharge, 0.1 second foot).

1908-1910 and 1915: Maximum stage recorded, 4.50 feet at 4 p. m. November 23, 1909 (discharge, 1,160 second-feet). Creek dry at various times on account of diversions above.

Winter flow.—Stage-discharge relation slightly affected during periods of cold weather; discharge can generally be estimated.

Diversions.—Considerable land irrigated along Ochoco Creek and tributaries above the station. Tableland and Elliott ditches divert water around the station. (See pp. ——.)

Regulation.—None.

Accuracy.—Results considered fair; gage readings somewhat questionable.

Discharge measurements of Ochoco Creek at Elliott's ranch, near Prineville, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	J. E. Stewart	0.59	0.1	Mar. 8	P. V. Hodges	1.22	34.1
Jan. 27	C. G. Paulsen	.82	6.5	Apr. 17	F. F. Henshaw	1.53	82.2
Mar. 8	P. V. Hodges	1.10	23.4	June 15	.....do	.92	12.0

iott's ranch, near Prineville, Oreg.,
30, 1915.

Feb.	Mar.	Apr.	May.	June.
28	60	200	15	19
45	76	245	15	15
34	93	290	15	15
23	112	232	15	15
21	130	175	15	10
19	120	162	15	6
17	111	150	15	3
15	23	140	12	1
19	23	130	10	2
23	34	130	8	3
21	45	130	6	3
19	60	120	10	3
17	76	111	15	3
15	84	102	30	3
15	93	93	45	11
15	102	87	39	6
24	111	81	33	4
33	120	70	33	3
34	130	60	33	3
39	130	46	28	3
36	130	33	23	3
33	165	24	19	3
39	200	15	15	3
45	188	30	24	3
52	175	45	33	3
60	152	30	33	3
60	130	15	33	6
60	165	10	28	10
....	200	6	23	10
....	200	10	23	10
....	200	....	23	....

curve. Gage read every other day and dis-
timated as 5 second-feet Dec. 12–31; 6 second-

h, near Prineville, Oreg., for the year
915.

harge in second-feet.			Run-off (total in acre-feet).	Accuracy.
m.	Minimum.	Mean.		
19	17	18.8	298	B.
15	....	7.61	468	C.
15	....	9.13	561	C.
60	15	30.8	1,710	B.
200	23	117	7,190	B.
290	6	99.1	5,900	B.
45	6	22.1	1,360	B.
19	1	6.17	367	C.
290	....	41.0	17,900	

EVILLE, OREG.

3 E., at the highway bridge in Prine-
the mouth of the creek.

December 15, 1913, to June 25, 1914;

daily. Gage reader, Hobart Reams.
e or by wading.
newhat shifting.

Extremes of discharge.—Maximum stage recorded during period March 7 to April 30, 2.30 feet at 4 p. m. March 30 (discharge, 160 second-feet). Creek dry April 28 to 30 and probably all summer.

The highest flood in recent years occurred in April, 1901, and reached a stage of about 9.0 feet on present gage (discharge estimated from a partly developed rating curve as 4,000 second-feet).

Diversions.—Station is below all diversions and shows only the unappropriated flow; the Rye Grass ditch diverts water within a mile above and carries water around the gage.

Regulation.—None.

Accuracy.—Results good.

Discharge measurements of Ochoco Creek at Prineville, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Dis charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	J. E. Stewart	1.24	1.3	Apr. 17	F. F. Henshaw	1.61	26.9
Jan. 27	C. G. Poulsen	1.32	4.3	June 15	.....do	1.09	1.0
Mar. 7	P. V. Hodges	1.66	30.2				

Daily discharge, in second-feet, of Ochoco Creek at Prineville, Oreg., for the year ending Sept. 30, 1915.

Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.
1	....	143	11	17	98	21	92	15
2	....	143	12	20	74	22	98	12
3	....	149	13	20	56	23	100	9
4	....	149	14	25	52	24	105	8
5	....	138	15	61	43	25	117	5
6	....	122	16	66	34	26	130	2
7	30	117	17	81	26	27	130	1
8	23	105	18	85	23	28	127	0
9	18	98	19	85	20	29	132	0
10	16	98	20	85	18	30	154	0
						31	149	....

Note.—Discharge determined from a well-defied rating curve. Discharge interpolated Apr. 15 and 18–22.

Monthly discharge of Ochoco Creek at Prineville, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 7-31	154	16	78.6	3,900	B.
April	149	0	58.7	3,490	B.

TABLELAND DITCH NEAR PRINEVILLE, OREG.

Location.—In the NW. ¼ sec. 5, T. 15 S., R. 16 E., at Elliott's ranch, about 1½ miles below intake, one-fourth mile upstream from station on Ochoco Creek, and about 6½ miles east of Prineville, Crook County.

Records available.—February 24 to June 9, 1915; that is, the irrigating season.

Gage.—Vertical staff on right bank just below a wasteway from which the surplus flow is returned to the creek; read every other day by David Elliott.

Discharge measurements.—Made by wading.

l material and shifts only slightly;

ed during year, 2.4 feet February
nal dry most of year.

k of Ochoco Creek in the NW. $\frac{1}{4}$
ward for about 8 miles, irrigating
ooked River.

eville, Oreg., during the year ending

Made by —	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
G. H. Brewster........	2.07	14.1
F. F. Henshaw.........	.86	a.2

near Prineville, Oreg., for the year
15.

y.	Feb.	Mar.	Apr.	May.	June.
......	......	13	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	......	14	14	14	......
......	18	13	14	14	......
......	19	12	14	14	......
......	20	13	14	14	......
......	20	14	14	14	......
......	20	14	14	14	......
......	......	14	14	14	......
......	......	14	13	14	......
......	......	14	......	14	......

rating curve. Mean discharge June 10–30

lle, Oreg., for the year ending Sept.

Discharge in second-feet.			Run-off (in acre-feet).
aximum.	Minimum.	Mean.	
20	18	19.4	192
20	0	12.0	738
14	12	13.9	827
14	12	13 4	824
14	.2	3.71	221
....	....	....	2,800

ELLIOTT DITCH NEAR PRINEVILLE, OREG.

Location.—In the NE. ¼ sec. 5, T. 15 S., R. 17 E., about 200 yards below intake, opposite gage on Ochoco Creek, and 6½ miles east of Prineville, Crook County.

Records available.—November 3, 1908, to April 30, 1910, and October 26, 1914, to June 30, 1915.

Gage.—Vertical staff driven in the right bank of canal; different gage was used 1908–1910. Gage reader, David Elliott.

Discharge measurements.—Made by wading or from a foot plank near the gage.

Channel and control.—Ditch flat and badly silted up; shifting.

Extremes of discharge.—Maximum stage recorded during year, 1.88 feet June 15 (discharge, 7.9 second-feet).

1908–1910 and 1915: Maximum stage recorded, 1.6 feet April 26 to 30, 1909 (discharge, 8.5 second-feet). Canal dry at times.

Winter flow.—Stage-discharge relation affected by ice at times.

Accuracy.—Results poor.

Elliott ditch diverts from the left bank of Ochoco Creek and irrigates 160 acres of land, mostly in alfalfa. Probably a considerable part of the water returns to the stream a short distance below.

Discharge measurements of Elliott ditch near Prineville, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	J. E. Stewart	1.53	1.1	June 15	F. F. Henshaw	1.88	7.9
Jan. 7	C. G. Paulsen	[a]1.03	1.2	16	Kennard and Luper	1.80	6.1
Mar. 8	P. V. Hodges	1.15	2.8				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Elliott ditch near Prineville, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	....	....	0.2	2.6	0	4.5	4.5
2	....	....	.2	2.9	0	4.5	4.5
3	....	....	.2	3.2	0	4.5	4.2
4	....	....	.2	2.6	0	4.5	3.8
5	....	....	.2	2.1	0	4.5	2.7
6	....	....	.1	1.8	0	4.5	1.6
7	....	....	.1	1.6	0	4.5	1.0
8	....	....	0	2.9	0	4.5	.5
9	....	....	.2	0	0	4.5	3.2
10	....	....	.5	0	0	4.2	5.9
11	....	....	.4	0	0	3.8	5.9
12	....	....	.4	0	0	4.5	5.9
13	....	....	.3	0	0	5.2	6.2
14	....	....	.2	0	0	5.0	6.6
15	....	....	.9	0	0	0	7.9
16	....	....	1.6	0	0	5.0	6.6
17	....	....	1.6	0	0	5.9	6.6
18	....	....	1.6	0	0	5.9	6.6
19	....	....	1.8	0	8.7	5.9	6.6
20	....	....	2.1	0	8.7	5.6	6.6
21	....	....	2.1	0	8.7	5.2	6.6
22	....	....	2.1	0	8.7	4.8	6.6
23	....	....	2.4	0	8.7	4.5	5.9
24	....	....	2.6	0	8.0	5.6	5.2
25	....	....	2.9	0	7.3	6.6	5.2
26	1.1	....	3.2	0	7.3	5.9	5.2
27	....	1.2	3.2	0	7.3	5.2	4.5
28	....	....	3.2	0	5.9	5.6	3.8
29	....	....	....	0	4.5	5.9	2.0
30	....	....	....	0	4.5	5.2	0
31	....	....	....	0	....	4.5	....

Note.—Discharge determined from a poorly defined rating curve. Gage read about every other day discharge interpolated for intervening days.

., for the year ending Sept. 30, 1915.

rge in second-feet.		Run-off (total in acre-feet).	Accuracy.
Minimum.	Mean.		
....	a 1.0	61.5	
....	a 1.0	59.5	
....	a .8	49.2	
....	a 1.0	61.5	
0	1.23	68.3	
0	.64	39.4	
0	2.94	175	C.
0	4.85	298	C.
0	4.75	283	C.
....	....	1,100	

nents and observer's notes.

VILLE, OREG.

, R. 16 E., on main road to Shaniko,

15.

abutment; read once daily by Mrs.

from bridge at higher stages.

ting.

rded during year, 2.0 feet March 23
eam bed dry up to February 24 and

e the station. Two canals divert
charge of the creek above diversions
nbined flow of the two ditches on
ion past the gage has been estimated.

*neville, Oreg., during the years ending
and 1916.*

.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*
27	P. V. Hodges..........	2.10	106
31	Hodges and Kennard..	1.85	63.9
19	H. G. Kennard........	.97	.9

scontinued, were used to define the curve for

Daily discharge, in second-feet, of McKay Creek near Prineville, Oreg., for the year ending Sept. 30, 1915.

Day.	Feb.	Mar.	Apr.	May.	Day.	Feb.	Mar.	Apr.	May.
1		6.0	64	1.2	16		44	4.2	1.2
2		2.5	80	1.2	17		57	6.0	1.2
3		2.5	88	1.2	18		57	6.0	1.2
4		12	57	1.2	19		50	6.0	1.2
5		9.0	57	1.2	20		50	6.0	1.2
6		4.2	44	1.2	21		57	6.0	1.2
7		2.5	44	1.2	22		72	6.0	1.2
8		2.5	38	1.2	23		88	4.2	1.2
9		1.2	32	1.2	24	0	72	2.5	1.2
10		1.8	32	1.2	25	2.5	57	6.0	1.2
11		2.5	26	1.2	26	2.5	32	1.8	.8
12		0	9	.8	27	1.2	32	1.8	.8
13		10	12	.8	28	6.0	32	1.8	.8
14		16	16	1.2	19		72	1.8	.8
15		57	12	1.2	30		72	1.2	.8
					31		64		.8

NOTE.—Discharge determined from a fairly well defined rating curve.

Monthly discharge of McKay Creek near Prineville, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
February	6.0	0	0.44	24	C.
March	88	0	33.5	2,060	B.
April	88	1.2	22.4	1,330	C.
May	1.2	.8	1.10	68	C.
The period				3,480	

NOTE.—The quantity of water diverted past the station has been estimated as 6 second-feet Feb. 25–28 (48 acre-feet); 10 second-feet for 25 days in March (496 acre-feet); 10 second-feet for April (595 acre-feet); 5 second-feet for May (307 acre-feet); total, 1,450 acre-feet. Total run-off of creek February to May, inclusive, 4,930 acre-feet.

METOLIUS RIVER AT ALLINGHAM RANGER STATION, NEAR SISTERS, OREG.

LOCATION.—In the NE. ¼ sec. 3, T. 13 S., R. 9 E., at Allingham ranger station, 1½ miles below mouth of Lake Creek, 3 miles below head of river, and about 17 miles northwest of Sisters. Station in Jefferson County.

DRAINAGE AREA.—50 square miles.

RECORDS AVAILABLE.—September 15, 1910, to October 31, 1913; June 21 to September 30, 1915.

GAGE.—Vertical staff on left bank 100 yards below bridge at ranger station; read by L. W. Zumwalt.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Gravel; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded June 21 to September 30, 0.56 foot at 5 p. m., June 21 (discharge, 327 second-feet), due to a heavy thunder shower. Minimum stage recorded, 0.40 foot September 28 (discharge, 264 second-feet).

1910–1913 and 1915: Maximum stage recorded, 0.97 foot February 16, 1912 (discharge, 566 second-feet); minimum stage recorded, 0.40 foot September 28, 1915 (discharge, 264 second-feet).

WINTER FLOW.—Stage-discharge relation unaffected by ice, as water comes from springs.

M. L. Merritt, supervisor.

ngham ranger station, near Sisters,
Sept. 30, 1915.

aw.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	0.55	329
....	.40	264

Allingham ranger station, near Sisters,
ept. 30, 1915.

Day.	June.	July.	Aug.	Sept.
	....	284	284	290
	....	284	284	284
	....	284	284	284
	....	290	284	284
	....	296	284	284
	327	296	284	284
	300	296	284	278
	296	296	284	272
	296	296	284	272
	296	296	284	272
	296	296	284	272
	296	296	284	272
	296	296	284	264
	296	284	284	264
	296	284	284	264
	....	284	284	....

rating curve. Gage read about every other
une 22 estimated.

n ranger station, near Sisters, Oreg.,
. 30, 1915.

harge in second-feet.			Run-off (total in acre-feet).	Accuracy.
m.	Minimum.	Mean.		
27	296	300	5,950	A.
96	284	289	17,800	A.
84	284	284	17,500	A.
96	264	282	16,800	A.
...	....	....	....	

TERS, OREG.

E., one-fourth mile below outlet of and about 15 miles northwest of Sis-

1; March to September, 1912; May
7 to September 30, 1915.

Gage.—Vertical staff on left bank, about 20 feet above weir; read two or three times a week by Harry Heising. Gage in natural channel used 1911 to 1913.

Discharge measurements.—Made by wading near gage.

Channel and control.—Trapezoidal weir 15 feet long, crest not quite level and somewhat rounded; some velocity of approach; rather unstable.

Extremes of discharge.—Maximum stage recorded during year, 1.33 feet April 22 (discharge, 81 second-feet); minimum stage recorded, 0.63 foot September 27 (discharge, 29 second-feet).

1911–1913 and 1915: Maximum discharge, 145 second-feet for a stage of 1.22 feet on old gage May 29, 1913.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None above station; one small ditch takes out of Lake Creek.

Regulation.—None.

Accuracy.—Results considered fair.

Discharge measurements of Lake Creek near Sisters, Oreg., during the year ending Sept. 30, 1915.

[Made by F. F. Henshaw.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-feet.*
June 22	0.82	46.3
Sept. 27	.63	25.0

Daily discharge, in second-feet, of Lake Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Day.	Apr.	May.	June.	July.	Aug.	Sept	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1			55		35		16			43			
2		72				32	17	76	69			32	
3			55		32		18			47	38		
4		78		40			19	78	65			32	35
5					32	32	20			47	38		
6		75	52	38			21		61				35
7	63						22	81		43	35	32	
8		69	52	38	32		23		61				35
9							24			43		32	
10	77	69	55		32		25	80	65		35		
11				38		32	26			43		32	35
12			52		32		27	75	61		35		29
13	78	72		38		35	28			43			
14			47				29	72	65		35	32	
15	80	69		38	32	35	30		61	40			32
							31					32	

Note.—Discharge determined from a poorly defined rating curve; given only for days on which gage was read.

Monthly discharge of Lake Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
April	76.0	4,520	C.	August	32.2	1,980	C.
May	67.5	4,150	C.	September	33.4	1,990	C.
June	47.8	2,840	C.				
July	37.2	2,290	C.	The period		17,800	

Note.—Monthly mean is average of determinations of discharge for days on which gage was read.

RS, OREG.

E., just above a trail crossing 1½
5 miles northeast of Sisters. Sta-

15.

ve weir; read two or three times a

weir 14.8 feet long, crest rounded;

led during year, 0.81 foot April 22
corded, 0.12 foot September 19 to

stream was frozen.

reg., during the year ending Sept. 30,

w.]

Gage height.	Dis-charge.
Feet.	*Sec.-ft.*
0.30	7.1
.16	.8

Sisters, Oreg., for the year ending

Apr.	May.	June.	July.	Aug.	Sept.
......	......	14	......	......	......
34	27	......	......	4.8	......
......	......	14	4.8	......	......
39	25	......	......	3.0	0.6
......	......	11	4.8	......	......
......	......	......	......	......	.6
42	......	11	4.8	3.0	......
......	25	......	......	......	.6
......	......	8.8	......	3.0	......
34	27	......	4.8	......	......
......	......	8.8	......	3.0	.6
34	25	......	4.8	......	1.2
......	......	6.6	......	......	......
40	25	......	4.8	3.0	......
......	26	6.6	......	......	1.5
......	......	......	......	3.0	......

efined between 1 and 50 second-feet; given

Monthly discharge of First Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
April	33.6	2,000	C.	August	4.03	248	B.
May	29.3	1,800	B.	September	1.83	109	C.
June	15.5	922	B.				
July	4.80	295	B.	The period		5,370	

NOTE.—Mean is the average of determinations of discharge for days on which gage was read.

JACK CREEK NEAR SISTERS, OREG.

LOCATION.—In the SE. ¼ sec. 28, T. 12 S., R. 9 E., at road crossing about half a mile north of Heising's ranch and 19 miles northeast of Sisters. Station is in Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 21 to September 27, 1915.

GAGE.—Vertical staff on left bank just above bridge; read about once a week. Gage reader, L. W. Zumwalt.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Loose gravel; shifting.

EXTREMES OF STAGE.—Maximum observed gage height, 0.62 foot September 27; minimum, 0.50 foot June 21 and 26. Discharge not a direct function of gage height.

WINTER FLOW.—Stage-discharge relation probably unaffected.

DIVERSIONS.—Heising's ditch diverts 1 second-foot or less above station for irrigation.

REGULATION.—None.

ACCURACY.—Results somewhat uncertain.

Discharge measurements of Jack Creek near Sisters, Oreg., during the year ending Sept. 30, 1915.

[Made by F. F. Henshaw.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 21	0.50	45.4
Sept. 27	.62	35.2

Daily discharge, in second-feet, of Jack Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1					16		44		
2					17				
3		47			18				
4				40	19				37
5					20				
6					21	46		42	
7			42		22				
8					23				
9					24		45		
10		43			25				34
11					26	46			
12				38	27				35
12			42		28			39	
14					29				
15					30				
					31		45		

NOTE.—Daily discharge determined by indirect method for shifting control; given only for days on which gage was read.

for the year ending Sept. 30, 1915.

onth.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
ber	36.8	2,190	C.
e period		8,380	

or days on which gage was read.

TERS, OREG.

E., about three-fourths mile above
0 miles northwest of Sisters; station

1915.

nk about 100 feet below new bridge;
Zumwalt.

fairly permanent.

orded during period of records, 1.98
ond-feet); minimum stage recorded,
second-feet).

ected by ice, as most of water is

States Forest Service, M. L. Merritt,

Sisters, Oreg., during the year ending
5.

nshaw.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	1.92	68.6
	1.82	57.7

near Sisters, Oreg., for the year ending
15.

Day.	June.	July.	Aug.	Sept.
		66		
				57
	69		58	
		66		
				57
	76			
				58
			58	
		62		

ined rating curve; given only for days on which

Monthly discharge of Canyon Creek near Sisters, Oreg., for the year ending Sept. 30, 1915.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
June 21-30	72.5	1,440	B.	September	57.2	3,400	B.
July	66.8	4,110	B.	The period		12,500	
August	58.0	3,570	B.				

NOTE.—Mean is the average of determinations of discharge for days on which gage was read.

SHITIKE CREEK AT WARM SPRING, OREG.

Location.—In the NE. ¼ sec. 26, T. 9 S., R. 12 E., at Warm Spring, Jefferson County, about 2 miles above mouth of creek and below all tributaries.

Drainage area.—Not measured.

Records available.—June 11, 1911, to September 30, 1915.

Gage.—Vertical staff on left bank opposite store; read once a day. Gage reader, Will H. See.

Discharge measurements.—Made by wading or from temporary footbridge near gage.

Channel and control.—Gravel and sand; likely to shift somewhat.

Extremes of discharge.—Maximum stage recorded during year, 1.50 feet at 2.15 p. m. May 13 (discharge, 175 second-feet); minimum stage recorded, 0.81 foot September 4 (discharge, 36 second-feet).

1911–1915: Maximum stage recorded, 2.50 feet January 14, 1912 (discharge, 593 second-feet); minimum is that of 1915.

Winter flow.—Stage-discharge relation somewhat affected by ice during short periods of cold weather.

Diversions.—Probably none above station.

Regulation.—Practically none. There is a small power plant just above the station.

Accuracy.—Results for 1915 considered excellent except for period when ice was present, for which time they are poor.

Discharge measurements of Shitike Creek at Warm Spring, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Oct. 25	P. V. Hodges	1.00	61.5	June 28	C. L. Batchelder	1.07	72.3
June 3	C. L. Batchelder	1.28	120	Sept. 4	do	.81	35.8

arm Spring, Oreg., for the year ending

Apr.	May.	June.	July.	Aug.	Sept.
111	100	122	71	47	41
122	100	134	80	47	41
111	111	118	80	47	41
111	111	118	90	47	36
111	111	118	90	41	41
111	111	100	80	41	41
111	111	100	80	41	41
111	111	90	80	41	41
111	122	90	90	41	41
111	122	84	90	41	41
122	122	84	80	41	41
122	134	84	71	41	41
122	175	80	62	41	47
122	147	80	62	41	45
122	134	71	59	41	41
134	111	71	59	41	41
134	100	71	59	41	41
122	100	71	59	41	41
122	100	62	59	41	41
122	100	62	54	41	41
111	111	62	54	41	41
122	111	62	54	41	41
122	111	62	54	41	41
122	111	62	47	41	41
111	122	62	62	41	41
111	161	62	62	41	41
111	122	71	62	41	41
100	122	71	62	41	41
100	122	71	62	41	41
100	111	80	62	41	41
......	111	......	62	41	......

rating curve. Mean discharge Dec. 16–30 esti-

ing, Oreg., for the year ending Sept. 30,

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
mum.	Minimum.	Mean.		
122	62	78.9	4,850	A.
147	62	93.2	5,550	A.
111	....	87.4	5,370	C.
100	47	63.8	3,920	B.
90	54	60.4	3,350	A.
122	59	90.6	5,570	A.
134	100	116	6,900	A.
175	100	118	7,260	A.
134	62	82.5	4,910	A.
90	47	67.7	4,160	A.
47	41	41.8	2,570	A.
47	36	41.2	2,450	A.
175	36	78.5	56,900	

ANTELOPE, OREG.

15 E., at J. H. Priday's ranch, about 2
miles east of Gateway, Jefferson County,
e, Wasco County.

31, 1915.

0 feet below a flume crossing and about
e reader, Mrs. J. H. Priday.
ling near gage.

Channel and control.—Stream bed of gravel and silt; one channel at all stages; no defined control.

Extremes of discharge.—Maximum stage during period March to September was 2.7 feet April 3 (discharge 92 second-feet). Minimum discharge recorded, 0.2 second-foot (gage height, 0.55 foot), August 6 to September 18.

Ice.—No record secured during winter.

Diversions.—Several canals divert water for irrigation above station, mostly in the vicinity of Ashwood.

Regulation.—None.

Accuracy.—Stage-discharge relation permanent between floods. Rating curve fairly well defined. Gage read twice a day to nearest tenth. Records fair.

Cooperation.—Field data furnished by State engineer of Oregon.

Discharge measurements of Trout Creek near Antelope, Oreg., during the year ending Sept. 30, 1915.

[Made by Rhea Luper.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 24	2.58	80
May 18	[a] 1.75	28.6
June 15	[a] 1.45	12.5

[a] Observer's reading; gage hard to read.

Daily discharge, in second-feet, of Trout Creek near Antelope, Oreg., during the year ending Sept. 30, 1915.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1		80	29	12	1.5	0.5	16		40	26	7	0.8	0.2
2		88	32	12	1.5	.5	17		34	26	3	.8	.2
3		92	32	8	1.2	.5	18		34	26	3.5	.8	.2
4		84	29	8	1.2	.5	19		34	24	3.5	.8	.2
5		68	29	7	1.0	.5	20		34	24	3.5	.5	.2
6		50	26	7	1.0	.5	21		29	22	2.5	.5	.2
7		54	24	7	1.0	.5	22		29	22	2.5	.5	.2
8		54	22	6	1.0	.5	23		29	24	2.5	.5	.2
9		50	15	6	1.0	.5	24	84	29	26	1.5	.5	.2
10		47	15	7	1.0	.5	25	76	29	26	1.5	.5	.2
11		44	15	9	1.0	.5	26	64	29	24	2.0	.5	.2
12		54	10	9	1.0	.5	27	61	29	24	2.0	.5	.2
13		58	12	9	1.0	.5	28	61	26	22	1.5	.5	.2
14		47	29	14	1.0	.5	29	88	26	22	1.5	.5	.2
15		47	29	14	.8	.5	30	84	26	22	1.5	.5	.2
							31	84		9		.5	.2

Monthly discharge of Trout Creek near Antelope, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 24-31	88	61	75.2	1,190
April	92	26	45.8	2,730
May	32	9	23.1	1,420
June	14	1.5	5.82	346
July	1.5	.5	.82	50
August	.5	.2	.35	22
The period				5,760

WAY, OREG.

, at Cram's lower ranch, just above
teway, Jefferson County.

•

5.

, Mrs. F. A. Moore.

gage.

floods.

ng period of records, 2.6 feet March
ed practically dry in April and

rozen.

nanent between floods; fairly well
daily to half tenths. Records good
ve 25 second-feet, which are fair.
gineer of Oregon.

y, Oreg., during the year ending Sept.

er.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	2.17	74
....	1.69	20.5

Gateway, Oreg., during the year ending
.

y.	Mar.	Apr.	May.	June.	July.	Aug.
....	......	28	......	11	20	......
....	......	11	......	11	20	......
....	......	......	21	28	20	......
....	......	......	......	35	20	......
....	......	......	......	35	22	......
....	......	......	......	33	16	......
....	......	4	......	24	13	......
....	......	2	......	9	13	......
....	......	2	......	2	11	......
....	78	2	......	4	11	......
....	60	13	......	2	11	......
....	55	2	......	2	11	......
....	55	......	......	2	13	......
....	115	......	......	2	13	......
....	57	2	......	2	13	......
....	130	......	......	......	13	......

HAY CREEK NEAR HAY CREEK, OREG.

Location.—In the N. ½ sec. 5, T. 11 S., R. 15 E., at McCue's ranch, 5 miles above mouth, 1½ miles north of Hay Creek post office, Jefferson County.

Records available.—March 26 to September 30, 1915.

Gage.—Inclined staff on right bank. Gage reader, Mrs. C. E. McCue.

Discharge measurements.—Made by wading near gage.

Channel and control.—Rocky and permanent; control about 18 feet below gage.

Extremes of discharge.—Maximum stage recorded March 26 to August 10, 1915, 4.6 feet July 30 (discharge, 1.2 second-feet); minimum stage recorded, 4.4 feet July 17 to 24 (discharge, 0.4 second-foot).

Ice.—No records during winter.

Diversions.—Considerable water diverted for irrigation above the station.

Regulation.—None.

Accuracy.—Stage-discharge relation fairly permanent. Rating curve poorly defined. Gage read daily to quarter tenths. Records poor.

A weir measurement of 0.5 second-foot on September 21 was made by C. E. Stricklin, assistant to State Engineer of Oregon.

Daily discharge, in second-feet, of Hay Creek near Hay Creek, Oreg., during the year ending Sept. 30, 1915.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1		0.8	1.0	1.1	0.7	0.7	16		1.0	1.0	1.0	0.7	
2		.8	1.0	1.1	.7		17		1.0	1.0	1.0	.4	
3		.8	1.0	.7	.7		18		1.0	1.0	1.0	.4	
4		.8	1.0	.7	.7	.7	19		1.0	1.0	1.0	.4	
5		.8	1.0	.7	.7		20		1.0	1.0	.7	.4	
6		.8	.7	.7	.7		21		1.0	1.1	.7	.4	
7		.8	.8	.7	.7	.7	22		1.0	1.1	.7	.4	
8		.8	.8	.8	.7		23		1.0	1.1	.7	.4	
9		.8	.8	.8	.7		24		1.0	1.1	.7	.4	
10		.8	1.0	.8	.7	.7	25		1.0	1.1	.7	.5	
11		.8	1.0	.9	.7		26	1.0	1.0	1.1	.7	.6	
12		.8	1.0	.9	.7		27	.8	1.0	1.1	.7	.7	
13		1.0	.8	1.0	.7		28	.8	1.0	1.1	.7	.7	
14		1.0	.8	1.0	.7		29	.8	1.0	1.1	.7	1.0	
15		1.0	1.0	1.0	.7		30	1.0	1.0	1.1	.7	1.2	
							31	.8		1.1		1.0	

Monthly discharge of Hay Creek near Hay Creek, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 26-31	1.0	0.8	0.87	10
April	1.0	.8	.92	55
May	1.1	.7	.99	61
June	1.1	.7	.82	49
July	1.2	.4	.65	40
August	.7		[a] .6	37
September			[a] .5	28
The period				280

[a] Estimated.

L, NEAR WARM SPRING, OREG.

11 E., at new sawmill above Badger
n Spring; station is in Wasco County.

a few measurements during summer.
above sawmill. Gage reader, Paul

ulders; may shift in extreme floods.
corded during period of record, 1.20
ge, 123 second-feet); minimum stage
t in July and September (discharge,

as read.

at He He sawmill, near Warm Spring,
g Sept. 30, 1915.

cchelder.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
30	1.14	*a* 109
. 5	1.10	97.1

n previous one.

ver at He He sawmill, near Warm Spring,
Sept. 30, 1915.

Day.	June.	July.	Aug.	Sept.
	102			
	102			
	109			
	109			
	109			
	109			
	109			
	109			
	109			
	109			
	117			
	117			
	106	97	97	

efined for range of stage observed.

WARM SPRING, OREG.

3 E., at bridge on road between Warm
former and 15 miles from the latter;

tember 30, 1915 (fragmentary prior to

Gage.—Stevens water-stage recorder since July 1, 1914; fastened to downstream side of right abutment. Gage reader, Willie Palmer. Vertical staffs spiked to upstream side of right abutment of old bridge July 29, 1911, to July 1, 1914.

Discharge measurements.—Made from upstream side of bridge or by wading.

Channel and control.—Gravel; practically permanent.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 1.62 feet from 3 to 7 a. m. April 4 (discharge, 642 second-feet); minimum stage from water-stage recorder, 0.73 foot January 15 (discharge, 192 second-feet).

1911–1915: Maximum stage recorded, 2.2 feet May 14, 1912 (discharge, 940 second-feet). This may have been exceeded between readings.

Winter flow.—River probably never freezes, as there are hot springs just above bridge.

Diversions.—None.

Regulation.—None.

Accuracy.—Results since recorder was installed are considered excellent; earlier records poor on account of fragmentary and uncertain gage records.

Discharge measurements of Warm Springs River near Warm Spring, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	P. V. Hodges..........	0.93	266	June 3	C. L. Batchelder.......	1.06	340
Nov. 29	C. G. Paulsen..........	.95	250	28	.....do.................	.91	264
Mar. 6	P. V. Hodges..........	1.18	384	Sept. 4	.....do.................	.84	232

Daily discharge, in second-feet, of Warm Springs River near Warm Spring, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	264	258	252	270	249	328	486	415	336	266	249	241
2	264	258	255	264	258	324	528	410	341	266	254	241
3	267	261	255	264	252	355	606	400	332	266	254	241
4	274	261	255	252	246	480	630	400	336	266	254	237
5	274	261	255	249	246	445	600	385	336	266	254	237
6	264	264	249	243	249	410	576	370	332	266	254	237
7	261	264	346	240	249	400	564	365	323	266	249	237
8	258	264	246	240	249	400	552	365	323	266	249	241
9	258	261	243	234	252	375	540	375	318	266	249	237
10	255	261	240	234	252	346	516	390	305	266	249	241
11	252	261	237	231	252	346	516	456	310	266	249	245
12	249	261	234	246	252	341	528	510	314	266	249	254
13	240	286	228	255	246	365	540	528	310	266	249	262
14	234	310	213	234	246	400	528	492	305	266	249	266
15	219	298	208	198	249	425	516	462	292	266	245	266
16	213	286	219	240	249	435	510	430	292	266	245	262
17	219	278	222	246	246	435	510	425	288	266	245	258
18	222	274	219	243	261	440	510	420	288	262	245	254
19	234	270	222	243	267	435	510	415	288	262	241	249
20	258	267	222	240	275	420	516	410	284	262	241	249
21	261	261	222	234	270	420	510	400	284	258	241	249
22	255	258	222	231	278	430	486	390	284	258	241	249
23	255	255	228	216	274	456	468	385	284	258	241	249
24	252	255	228	219	332	486	450	380	279	258	241	254
25	252	255	228	213	390	498	450	380	275	258	241	254
26	252	255	228	228	346	486	420	375	275	254	241	254
27	252	255	228	234	324	456	410	365	271	254	241	254
28	252	255	228	234	310	425	410	365	266	254	241	254
29	249	255	228	234	....	456	410	370	266	254	241	254
30	249	255	228	234	....	474	415	360	266	249	241	254
31	249	....	246	237	....	486	....	350	....	249	241	....

Note.—Discharge determined from two well-defined rating curves, applicable Oct. 1 to Mar. 3 and Mar. 4 to Sept. 30, respectively. Discharge interpolated July 3–10 and Aug. 19 to Sept. 3.

Varm Spring, Oreg., for the year ending
15.

ischarge in second-feet.			Run-off (total in acre-feet).	Accuracy.
num.	Minimum.	Mean.		
274	213	250	15,400	B.
310	255	265	15,800	A.
255	208	233	14,300	B.
270	198	238	14,600	B.
390	246	270	15,000	B.
498	324	419	25,800	A.
630	410	507	30,200	A.
528	350	405	24,900	A.
341	266	300	17,900	A.
266	249	262	16,100	A.
254	241	246	15,100	A.
266	237	249	14,800	A.
630	198	304	220,000	

RM SPRING, OREG.

E., unsurveyed, 500 feet below Indian
h of Boulder Creek, and 20 miles north-

30, 1915.

vagon bridge; read occasionally. Gage
ng.

y permanent.

recorded during period of records, 1.35
minimum stage recorded, 0.88 foot and

nt.

s when gage was read, good.

arm Spring, Oreg., during the year ending
1915.

Batchelder.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	1.35	70.5
....	1.00	46.2
....	.89	36.8

Daily discharge, in second-feet, of Mill Creek near Warm Spring, Oreg., for the year ending Sept. 30, 1915.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1					16				
2					17	52			
3					18				
4			38		19			37	
5	71		37	37	20			38	
6		45			21				
7		44			22				
8	63	45			23				
9		45			24				
10	58				25	48			
11					26				
12					27				
13					28				
14					29	45	38		
15					30		38		38
					31				

NOTE.—Discharge determined from well-defined rating curve; given only for days on which gage was read.

WHITE RIVER NEAR TYGH VALLEY, OREG.

Location.—In the SW. ¼ sec. 10, T. 4 S., R. 13 E., a mile south of Tygh Valley, Wasco County, a mile above mouth of Tygh Creek, and 4 miles above the Tygh Valley plant of Pacific Power & Light Co. at the fall of White River.

Drainage area.—Not measured.

Records available.—June 18, 1911, to September 30, 1915.

Gage.—Vertical staff on lower corner of left pier of highway bridge; read once daily. Gage reader, Gertrude Brown.

Discharge measurements.—Made from lower side of highway bridge.

Channel and control.—Gravel and sand; slightly shifting. White River carries a heavy load of glacial sediment at times.

Extremes of discharge.—Maximum stage recorded during year, 1.92 feet at 8 a. m. April 3 (discharge, 797 second-feet); minimum stage recorded, 0.30 foot September 7, 20, 24, and 27 (discharge, 82 second-feet).

1911–1915: Maximum stage recorded, 5.3 feet January 9, 1912 (probably ice-affected); maximum when channel was clear, 3.5 feet January 13, 1912 (discharge, 2,050 second-feet). Minimum is that of 1915.

Winter flow.—Stage-discharge relation affected by ice for short periods; ice jams occasionally form during extremely cold weather.

Diversions.—Probably no diversion from White River above station, although diversion of water for irrigation of lands south of lower White River is feasible.

Regulation.—None.

Accuracy.—Results considered good.

Discharge measurements of White River near Tygh Valley, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 22	P. V. Hodges	0.60	180
Aug. 17	C. L. Batchelder	.44	127
Sept. 3	.....do	.37	96.7

Tygh Valley, Oreg., for the year ending
5.

.	Apr.	May.	June.	July.	Aug.	Sept.
10	485	320	245	152	142	104
10	560	300	228	152	136	96
60	785	300	228	152	136	104
10	642	308	228	152	129	104
85	560	300	228	152	129	96
60	535	300	210	152	129	96
20	560	300	210	162	129	82
00	510	300	210	169	129	96
280	485	340	210	169	129	96
245	460	360	200	152	129	96
245	460	340	210	152	129	96
245	510	360	228	152	129	110
245	510	385	193	152	129	116
300	485	340	193	152	129	126
340	435	300	193	152	129	110
385	460	308	186	152	120	110
360	460	300	186	169	126	96
360	460	300	176	152	126	110
360	485	280	176	152	126	116
340	460	280	176	152	116	82
360	435	262	159	176	126	88
410	410	262	159	169	110	88
460	385	262	159	152	116	96
535	410	280	159	152	110	82
485	360	262	159	152	116	88
435	340	262	176	152	110	88
385	360	280	166	152	110	82
360	385	320	159	152	110	88
460	340	280	152	152	110	96
435	320	262	159	153	110	96
460	....	262	....	136	110	....

Apr. 3 from a well-defined rating curve; Apr. 4 to
s are the same above 2,000 second-feet. Discharge
harge relation was affected by ice.

Valley, Oreg., for the year ending Sept. 30,

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
aximum.	Minimum.	Mean.		
228	130	162	9,960	B.
228	156	188	11,200	B.
210	150	179	11,000	B.
485	150	192	11,800	B.
535	210	293	16,300	B.
535	245	369	22,700	B.
785	320	468	27,800	B.
385	262	300	18,400	B.
245	152	191	11,400	B.
176	136	155	9,530	B.
142	110	123	7,560	B.
126	82	97.8	5,820	B.
785	82	226	163,000	

IVER BASIN.

AR GLENWOOD, WASH.

R. 12 E., just below Dairy Creek, 2½ miles
Yakima Indian Reservation, 3 miles below
north of Glenwood, Klickitat County.

0, to September 30, 1915, at present site;
), at a point a mile above, in section 11.

Gage.—Stevens continuous water-stage recorder referred to vertical staff on left bank. Gage reader, A. G. Hanson. Prior to July 19, 1910, several vertical staffs were used.

Discharge measurements.—Made at a cable bridge just below gage.

Channel and control.—Heavy gravel; may shift during high water.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 2.62 feet at 1 a. m. April 3 (discharge, 2,200 second-feet); minimum stage from water-stage recorder, 0.55 foot at 11 a.m. January 22 (discharge, 302 second-feet).

1909–1915: Maximum stage recorded, 5.20 feet on original gage November 24. 1909 (discharge, estimated by extension of rating curve, 6,250 second-feet). Minimum, that of 1915.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered excellent.

Discharge measurements of Klickitat River near Glenwood, Wash., during the year ending Sept. 30, 1915.

[Made by A. G. Hanson.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Feb. 20	0.74	376	July 25	1.09	545
April 18	2.22	1680	Aug. 29	1.08	581
May 23	1.62	900	Sept. 18	.82	393
June 13	1.35	716			

Daily discharge, in second-feet, of Klickitat River near Glenwood, Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	527	719	......	452	419	436	1,280	1,110	965	692	532	436
2	551	839	......	441	408	430	1,960	1,110	920	700	563	424
3	539	1,280	......	430	402	424	2,100	1,060	880	708	538	436
4	515	1,120	......	424	392	446	1,820	1,010	880	692	502	460
5	515	938	......	424	402	441	1,610	1,010	880	671	502	448
6	515	839	......	424	397	441	1,470	1,010	920	636	526	402
7	515	762	......	424	397	441	1,470	1,060	880	615	502	392
8	509	712	......	430	397	441	1,400	1,110	840	692	496	402
9	503	691	......	419	397	441	1,280	1,280	800	629	490	386
10	551	657	......	414	397	441	1,280	1,280	760	582	496	370
11	551	684	......	414	380	441	1,400	1,220	738	570	496	364
12	612	785	......	419	392	446	1,470	1,160	723	576	490	370
13	618	1,120	......	419	392	463	1,470	1,110	723	550	478	358
14	599	938	......	424	370	551	1,340	1,010	723	538	478	358
15	593	808	......	414	380	664	1,340	965	715	520	490	370
16	581	740	......	370	397	684	1,400	920	723	526	490	380
17	587	684	......	402	414	684	1,540	1,110	745	526	478	397
18	624	657	......	402	414	691	1,680	1,110	715	530	478	402
19	785	664	......	397	402	677	1,750	1,060	685	534	496	402
20	726	698	......	380	397	677	1,750	1,010	671	540	496	397
21	670	670	......	386	397	740	1,540	965	664	545	508	402
22	638	650	......	335	408	808	1,400	965	671	550	520	397
23	605	644	......	360	408	938	1,280	965	678	555	532	392
24	593	638	......	350	452	938	1,220	965	671	559	526	392
25	575	631	......	360	463	895	1,220	920	643	563	508	397
26	569	625	......	397	441	831	1,160	920	629	538	508	397
27	563	618	446	419	430	778	1,160	1,010	615	508	496	386
28	557	612	446	424	436	823	1,160	1,220	602	490	514	386
29	551	606	441	419	......	887	1,220	1,110	622	502	526	397
30	569	600	441	414	......	938	1,160	1,010	657	526	538	397
31	612	......	441	408	......	895	......	965	......	520	460	......

Note.—Discharge determined as follows: Oct. 1 to Apr. 3, from a well-defined rating curve; Apr. 4 to Sept. 30, from a rating curve well defined between 375 and 1,000 second-feet. Discharge Nov. 25–26, interpolated; Nov. 28–30, estimated. Mean discharge Dec. 1–26, estimated as 500 second-feet by comparison with records of White Salmon River (recorder not working during this period).

, *Wash., for the year ending Sept. 30,*

e miles.]

et.		Run-off.		
.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
81	1.63	1.88	35,700	B.
54	2.12	2.36	44,900	A.
91	1.38	1.59	30,200	C.
06	1.14	1.31	25,000	A.
06	1.14	1.19	22,500	A.
40	1.80	2.08	39,400	A.
40	4.04	4.51	85,700	B.
60	2.98	3.44	65,200	A.
45	2.09	2.33	44,300	A.
77	1.62	1.87	35,500	A.
05	1.42	1.64	31,100	A.
97	1.12	1.25	23,600	A.
67	1.87	25.45	483,000	

LENWOOD, WASH.

ty bridge on road between Glenwood f Glenwood.

er 24, 1914, when station was dis-

idge. Read once daily by L. Leidl. am side of bridge.

gravel and small boulders; likely to

corded during period, 1.40 feet July ninimum stage, 0.88 foot at 6 p. m.).

fected by ice.

irrigation near Glenwood.

ments furnished by L. Leidl.

River below Glenwood, Wash.

te.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*
15.			
26	A. G. Hanson..........	1.55	1,320
20	.....do..................	1.15	94.7

Daily discharge, in second-feet, of Klickitat River below Glenwood, Wash., for the period July 16 to Oct. 24, 1914.

Day.	July.	Aug.	Sept.	Oct.	Date.	July.	Aug.	Sept.	Oct.
1		1,010	866	780	16	1,190	930	766	
2		1,060	866	780	17	1,140	930	815	
3		1,060	850	815	18	1,190	930	890	890
4		970	850	850	19	1,170	930	930	890
5		970	890	850	20	1,170	914	1,030	1,140
6		970	890	815	21	1,140	890	1,010	1,100
7		970	890	815	22	1,060	866	930	1,100
8		970	866	815	23	1,060	890	850	1,060
9		946	866		24	1,060	866	850	930
10		946	850		25	1,060	850	815	
11		944	850		26	1,060	850	815	
12		941	836		27	1,010	914	815	
13		938	836		28	1,060	890	780	
14		935	815		29	1,040	850	780	
15		932	780		30	1,060	850	780	
					31	1,010	890		

NOTE.—Discharge determined from a rating curve well defined between 850 and 1,400 second-feet.

Monthly discharge of Klickitat River below Glenwood, Wash., for the period July 16 to Oct. 24, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July 16-31	1,190	1,010	1,090	34,600
August	1,060	850	929	57,100
September	1,030	766	855	50,900

HOOD RIVER BASIN.

HOOD RIVER AT DEE, OREG.

LOCATION.—In the SW. ¼ sec. 7, T. 1 N., R. 10 E., just above the backwater of the milldam at Dee, Hood River County, and half a mile below the junction of East and Middle forks.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 21, 1913, to December 31, 1914; February 1 to September 30, 1915.

GAGE.—Vertical staff attached to wooden crib on left bank just above railroad trestle. Gage reader, J. W. West. Gage 400 feet below dam was used 1913 to December 31, 1914.

DISCHARGE MEASUREMENTS.—Made from cable about 25 feet above gage.

CHANNEL AND CONTROL.—Control of boulders, stumps, and gravel; probably permanent between floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the period February 1 to September 30 at upper station, 2.4 feet at 1 p. m. April 1 (discharge can not be computed); minimum stage recorded, 0.58 foot September 7, 10, and 11 (discharge, 134 second-feet); this is probably about as low a stage as the river ever reaches. No record of extreme flood.

WINTER FLOW.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—Several small ditches divert water for irrigation above station. The East Fork Irrigation District canal diverts water through a divide to lands outside the drainage area.

REGULATION.—None. The flow at former station is quite irregular, especially during low water, owing to changes in load in power plant at mill of Oregon Lumber Co. just above gage.

ACCURACY.—Records considered good for low stages; no estimates for high stages at present gage; good for old gage except for extremely low water.

reg., during the year ending Sept., 30,

helder.]

Gage height.	Dis-charge.
Feet.	*Sec.-ft.*
0.81	226
.80	232
.72	186

Oreg., for the year ending Sept. 30, 1915.

Day.	Feb.	Mar.	Apr.	May.
	1.05	1.70	1.65	1.45
	1.05	1.65	1.80	1.50
	1.08	1.65	1.75	1.50
	1.08	1.65	1.75	1.50
	1.08	1.55	1.70	1.50
	1.08	1.55	1.65	1.60
	1.08	1.55	1.60	1.55
	1.10	1.70	1.70	1.40
	1.30	1.70	1.70	1.55
	1.28	1.65	1.60	1.45
	1.18	1.65	1.60	1.35
	1.20	1.58	1.65	1.45
	1.28	1.58	1.65	1.70
	....	1.58	1.55	1.40
	....	1.58	1.50	1.45
	....	1.70	....	1.45

ring this period and a shift in control occurred scharge not determined.

Dee, Oreg., for the year ending Sept. 30,

Nov.	Dec.	June.	July.	Aug.	Sept.
515	330	625	265	225	250
416	355	400	305	348	180
570	330	400	335	305	180
405	345	400	348	250	225
380	251	400	305	250	180
330	260	400	348	287	140
365	282	400	287	250	134
330	260	335	456	225	140
365	260	335	456	235	140
380	282	275	305	265	134
449	260	305	305	250	134
416	260	275	275	216	140
690	215	275	250	202	160
460	238	275	250	202	160
395	251	275	225	202	180
405	251	400	368	250	225
395	215	265	275	225	202
345	215	235	235	202	202
315	215	235	235	225	202
330	206	225	265	265	202
345	200	414	305	275	216
330	200	435	287	275	225
345	200	387	265	287	216
315	200	287	265	265	202
355	224	250	275	250	202
315	238	265	235	287	225
365	260	202	225	250	202
330	260	202	225	323	189
305	224	202	216	368	202
355	238	225	225	400	216
....	238	....	225	250	....

ings on gage below dam and a well-defined rating a rating curve well defined between 180 and 250 puted.

Monthly discharge of Hood River at Dee, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	504	260	371	22,800	B.
November	690	305	387	23,000	B.
December	355	200	250	15,400	B.
June	625	202	320	19,000	C.
July	456	216	285	17,500	B.
August	400	202	262	16,100	B.
September	250	134	187	11,100	B.

HOOD RIVER AT TUCKER BRIDGE, NEAR HOOD RIVER, OREG.

Location.—In the SW. ¼ sec. 15, T. 2 N., R. 10 E., one-third mile above intake of power flume, about three-fourths mile above Tucker Bridge, and 5 miles south of the town of Hood River, Hood River County.

Drainage area.—Not measured.

Records available.—July 24 to September 30, 1915; October 20, 1897, to December 31, 1899, and August 27, 1913, to September 30, 1914, from gage at highway bridge.

Gage.—Stevens water-stage recorder on right bank. Gage reader, Fred Knoblock. Chain gage attached to highway bridge, used 1913 and 1914. Gage used 1897 to 1899 was of wire type and was attached to older bridge.

Discharge measurements.—Made from highway bridge; flow of flume included with that of river; conditions only fair.

Channel and control.—Rocks and boulders; practically permanent.

Extremes of discharge.—Maximum stage from water-stage recorder July 24 to September 30, 1915, 1.60 feet at 9 a. m. August 7 (discharge, 580 second-feet); minimum stage recorded, 0.62 foot at 1 a. m. September 16 (discharge, 136 second-feet).

1897–1899 and 1913–1915: Maximum stage recorded, 11.0 feet on old wire gage January 21, 1899 (discharge, 12,200 second-feet); minimum is that of 1915.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—Several large diversions for irrigation above station. Power flume diverts a few hundred feet above the bridge and discharges directly below it; quantity diverted included in determinations.

Regulation.—Water stored at sawmill at Dee. During low water the pond was filled and emptied as many as six times daily, causing fluctuations of as much as 0.8 foot at Tucker Bridge.

Accuracy.—Results for 1915 considered good.

Discharge measurements of Hood River at Tucker Bridge, near Hood River, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	Hodges and Stewart	[a]1.82	619	Aug. 20	C. L. Batchelder	[b]1.40	467
Nov. 18	Paulsen and Hanson	[a]2.41	819	Sept. 2	do	[b].70	159
July 28	C. L. Batchelder	[b]1.45	479				

[a] From chain gage.

[b] From water-stage recorder.

ucker Bridge, near Hood River, Oreg.,
. 30, 1915.

g.	Sept.	Day.	July.	Aug.	Sept.
5	280	21	......	335	316
0	300	22	......	360	315
0	300	23	......	376	301
0	295	24	395	349	287
0	274	25	378	346	315
5	291	26	385	351	310
0	302	27	356	350	305
2	286	28	340	341	293
4	298	29	328	364	292
0	312	30	316	390	292
		31	355	336	......

efined above 150 second-feet; discharge inte-

e, near Hood River, Oreg., for the year
15.

charge in second-feet.			Run-off (total in acre-feet).	Accuracy.
um.	Minimum.	Mean.		
395	316	357	5,660	A.
453	310	374	23,000	A.
332	260	296	17,600	A.

AR HOOD RIVER, OREG.

E., at bridge of Mount Hood Railway
of Hood River, Hood River County,
plant of Pacific Power & Light Co.,

ember 30, 1915.

k just below bridge, installed July 27,
ur readings daily before recorder was
lings on vertical staff on right bank
bove railroad bridge, in SE. ¼ sec. 36,

e 100 feet above gage at power plant.
practically permanent.

corded during year, 4.7 feet November
nd-feet); minimum stage from water-
discharge, estimated from downward
).

5.0 feet January 5, 1914 (discharge,
5.

naterially affected by ice.

above station; water for power plant
rned above the bridge gage; diversion
computed separately for 1914.

Dee causes sudden fluctuations at low

Discharge measurements of Hood River at Powerdale, near Hood River, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height opposite power house.	Discharge.			Gage height at bridge.
			At cable.	At tailrace.	At bridge.	
		Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Feet.*
Oct. 7	J. E. Stewart	1.82	533	78.9	612	....
7	.....do	1.80	482	78.9	561	....
Nov. 18	Paulsen and Hanson	2.41	883	95.6	979	[a] 3.02
July 27	C. L. Batchelder	1.47	284	99.5	383	2.17
Aug. 18	.....do	1.66	409	65.7	475	2.36
18	.....do	1.20	241	93.7	335	1.90

[a] Gage read two hours after measurement was made and stage was apparently falling.

Daily discharge, in second-feet, of Hood River at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	560	865	760	725	980	980	2,530	865	865	495	408	334
2	1,020	980	760	725	980	980	2,390	830	830	560	465	340
3	830	1,550	725	760	980	940	2,530	795	725	495	435	322
4	760	1,160	690	690	830	1,020	2,250	690	690	495	380	325
5	725	1,160	658	690	900	1,120	1,940	690	690	528	380	340
6	658	1,200	690	658	900	1,120	1,720	725	725	528	360	325
7	658	980	625	625	865	980	1,770	690	725	495	340	290
8	625	940	658	625	830	980	1,600	725	690	560	340	302
9	625	900	625	658	795	980	1,500	690	625	625	340	334
10	690	865	625	658	760	980	1,400	1,160	592	495	340	325
11	658	980	592	625	795	940	1,500	1,160	560	435	360	340
12	830	1,160	592	658	760	980	1,450	1,120	560	435	340	310
13	690	2,600	528	790	760	1,070	1,550	1,070	560	435	334	316
14	725	1,770	528	1,250	760	1,770	1,350	980	528	495	331	325
15	658	1,450	528	1,160	725	2,120	1,250	865	528	495	340	310
16	625	1,200	528	940	725	2,120	1,250	865	560	495	348	325
17	725	1,070	495	940	760	1,770	1,350	865	528	625	360	340
18	725	980	465	860	830	1,770	1,350	900	690	495	360	340
19	1,600	940	435	795	830	1,550	1,250	980	560	495	360	364
20	1,160	980	435	725	865	1,450	1,250	940	560	495	380	380
21	1,020	830	528	690	900	1,450	1,200	900	495	495	380	380
22	900	900	560	658	900	1,500	1,120	865	495	495	380	380
23	830	900	560	658	830	1,770	1,070	865	560	465	435	290
24	760	830	528	625	1,120	1,770	1,070	865	658	495	380	340
25	690	830	625	625	1,250	1,550	1,020	830	592	435	380	360
26	690	795	658	592	1,250	1,400	1,020	830	528	408	380	340
27	625	760	625	592	1,070	1,250	980	900	658	360	435	340
28	625	830	830	592	900	1,250	980	1,250	495	435	465	334
29	625	830	625	592	....	1,450	980	940	495	380	408	347
30	690	760	760	592	....	1,500	900	940	495	376	408	360
31	690	....	725	658	....	1,450	....	865	....	380	408	....

NOTE.—Discharge determined from a rating curve well defined between 350 and 2,000 second-feet. Records from water-stage recorder July 27 to Sept. 30 not so good as those at Tucker Bridge.

near Hood River, Oreg., for the year 1915.

ischarge in second-feet.			Run-off (total in acre-feet).	Accuracy.
num.	Minimum.	Mean.		
,600	560	764	47,000	B.
2,600	760	1,070	63,700	B.
830	435	612	37,600	B.
1,250	592	724	44,500	B.
1,250	725	888	49,300	B.
2,120	940	1,350	83,000	A.
2,530	900	1,450	86,300	A.
1,250	690	892	54,800	B.
865	495	609	36,200	B.
625	360	481	29,600	B.
465	331	379	23,300	B.
380	290	335	19,900	B.
2,600	290	795	575,000	

AKE, NEAR MOUNT HOOD, OREG.

) E., 1,000 feet above the intake of the ee-fourths mile above toll bridge and Hood post office, Hood River County.

r 30, 1915.

er installed on left bank. Gage reader,

le 15 feet below gage.

practically permanent.

recorded July 22 to September 30, 1.73 second-feet); minimum stage recorded, arge, 115 second-feet).

been obtained.

small ditches divert water for irrigation

d River above intake, near Mount Hood, ding Sept. 30, 1915.

Batchelder.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Aug. 22	1.52	155
Sept. 17	1.30	122

Daily discharge, in second-feet, of East Fork or Hood River above intake, near Mount Hood, Oreg., for the year ending Sept. 30, 1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	......	156	142	11	......	160	133	21	......	161	123
2	......	169	138	12	......	156	135	22	167	165	132
3	......	165	142	13	......	152	132	23	165	165	127
4	......	156	145	14	......	151	128	24	165	163	122
5	......	161	143	15	......	151	125	25	161	156	126
6	......	169	136	16	......	160	133	26	158	156	124
7	......	163	132	17	......	156	132	27	152	151	121
8	......	158	132	18	......	152	133	28	151	156	122
9	......	160	132	19	......	156	132	29	149	163	125
10	......	165	136	20	......	160	132	30	142	180	128
								31	147	161	......

NOTE.—Discharge determined from a well-defined rating curve. Discharge Sept. 13-14 interpolated.

Monthly discharge of East Fork of Hood River above intake, near Mount Hood, Oreg., for year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 22-31	167	142	156	3,090	A.
August	180	151	160	9,840	A.
September	145	121	127	7,560	A.

EAST FORK OF HOOD RIVER NEAR MOUNT HOOD, OREG.

LOCATION.—In the NE. ¼ sec. 5, T. 1 S., R. 10 E., about 5 miles above mouth of East Fork, 2 miles south of Mount Hood post office, Hood River County, and 2 miles east of Parkdale station on the Mount Hood Railroad.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 17, 1913, to November 14, 1914, when station was discontinued.

GAGE.—Vertical staff on right bank. Gage reader, J. A. Robertson.

DISCHARGE MEASUREMENTS.—Made from a cable one-half mile above gage or by wading.

CHANNEL AND CONTROL.—Gravel and small boulders; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period October 1 to November 14, 1914, 5.55 feet November 12 and 13 (discharge, 224 second-feet); minimum stage recorded, 5.25 feet October 6 and 7 (discharge, 139 second-feet).

1913–1914: Maximum stage recorded, 6.65 feet June 22, 1913 (discharge, 762 second-feet); minimum stage recorded, 4.85 feet September 8, 1914 (discharge, 66 second-feet).

WINTER FLOW.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—The East Fork Irrigation District canal diverts water about three-fourths mile and the Mount Hood ditch about one-fourth mile above gage and carry their water past the gage. The Glacier ditch diverts water about 6 miles above gage and waters lands above station.

REGULATION.—None.

ACCURACY.—Results considered good.

The following discharge measurement was made by Paulsen and Hanson:

Nov. 19: Gage height, 5.40 feet; discharge, 172 second-feet.

Hood River near Mount Hood, Oreg., for
Nov. 14, 1914.

ct.	Nov.	Day.	Oct.	Nov.
164	208	21	151	....
164	224	22	151	....
139	224	23	151	....
151	208	24	178	....
151	....	25	178	....
164	....	26	193	....
178	....	27	208	....
178	....	28	193	....
164	....	29	208	....
164	....	30	208	....
		31	208	....

g curve.

near Mount Hood, Oreg., for the period
14, 1914.

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
mum.	Minimum.	Mean.		
208	139	172	10,600	B.
224	178	197	5,480	B.

NAL NEAR MOUNT HOOD, OREG.

E., a mile below intake, about 1½ miles
es east of Parkdale station on the Mount

ber 26, 1914; July 21 to September 30,

r on left side of canal just above road
Vertical staff on side of flume, 1,000
to October, 1914.
way bridge or by wading.
n; head of flume probably acts as con-

uring period July 21 to September 30,
August 14 at 8 p. m. (discharge, 106
er and at various other times.
ather.

ts water in the SW. ¼ sec. 4, T. 1 S., R.
iver. Most of the return water reaches

Discharge measurements of East Fork Irrigation District canal near Mount Hood, Oreg., during the year ending Sept. 30, 1915.

[Made by C. L. Batchelder.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
July 22	2.56	77.7	July 24	2.34	65.7
24	1.78	36.0	Aug. 22	2.75	85.6

Daily discharge, in second-feet, of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	July.	Aug.	Sept.	Day.	Oct.	July.	Aug.	Sept.
1	20	....	71	77	16	23	....	96	40
2	20	....	42	76	17	23	....	79	40
2	20	....	82	75	18	23	....	92	41
4	22	....	85	74	19	22	....	93	42
5	22	....	86	73	20	22	....	95	44
6	22	....	88	72	21	13	82	95	41
7	22	....	92	71	22	7.0	81	95	35
8	22	....	93	70	23	13	78	96	36
9	22	....	94	63	24	3.0	57	95	35
10	23	....	96	61	25	5.0	76	94	35
11	23	....	95	61	26	13	80	94	35
12	22	....	95	61	27	0	82	93	35
13	22	....	95	58	28	0	82	91	35
14	23	....	98	38	29	0	83	88	36
15	23	....	97	38	30	0	82	86	35
					31	0	83	77	....

NOTE.—Discharge for October determined from readings on gage in flume and a well-defined rating curve; for July to September, from records of water-stage recorder and a well-defined rating curve. Discharge Sept. 1-7 interpolated. Water probably turned in about May 1; no record obtained until July 21.

Monthly discharge of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	23	0	16.0	984	A.
July 21-31	83	57	78.7	1,720	A.
August	98	42	89.3	5,490	A.
September	77	35	51.1	3,040	A.

WEST FORK OF HOOD RIVER NEAR DEE, OREG.

LOCATION.—In the SW. ¼ sec. 1, T. 1 N., R. 9 E., about 500 feet below an old bridge, about a mile from mouth, and 2 miles by road west of Dee, Hood River County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 26, 1913, to September 30, 1914; January 1 to September 30, 1915.

GAGE.—Vertical staff on right bank attached to stump. Gage reader, Fred Pilling.

DISCHARGE MEASUREMENTS.—Made by wading at low water. No equipment for high-water measurement.

CHANNEL AND CONTROL.—Rocky; probably permanent.

stage recorded during year, 3.00 feet at 7 a. m.
d); minimum stage recorded, 1.00 foot Sep-
cond-feet).
ded, 4.00 feet January 5, 1914 (discharge not
915.
n unaffected by ice.
or irrigation near Dee, and some from Green-

dered excellent; no estimates for high stages.

Hood River near Dee, Oreg., during the year
t. 30, 1915.

e.	Date.	Made by—	Gage height.	Discharge.
t.			*Feet.*	*Sec.-ft.*
3	Aug. 21	C. L. Batchelder	1.15	165
1	Sept. 17	.....do	1.04	111

Hood River near Dee, Oreg., for the year ending
30, 1915.

.	Day.	Jan.	Feb.	Mar.	Apr.	May.
8	16	1.72	1.48	2.30	1.80	1.60
5	17	1.62	1.48	2.02	1.80	1.60
5	18	1.60	1.60	2.05	1.75	1.60
2	19	1.58	1.58	2.00	1.72	1.60
2	20	1.50	1.58	1.95	1.72	1.60
2	21	1.48	1.58	1.95	1.70	1.60
0	22	1.48	1.58	1.95	1.70	1.60
0	23	1.48	1.58	2.15	1.75	1.60
2	24	1.45	1.72	2.15	1.72	1.60
2	25	1.45	1.85	2.00	1.65	1.58
5	26	1.48	1.80	1.95	1.65	1.58
5	27	1.40	1 72.	1.95	1.62	1.58
2	28	1.40	1.70	1.90	1.62	1.85
0	29	1.40	....	1.95	1.60	1.70
0	30	1.38	....	1.95	1.60	1.65
	31	1.45	....	2.00	....	1.60

k of Hood River near Dee, Oreg., for the years
30, 1913, 1914, and 1915.

	Sept.	Day.	Sept.
		1913.	
	232	21	244
	232	22	268
	250	23	226
	226	24	200
	220	25	195
	232	26	200
	232	27	195
	226	28	215
	215	29	215
	220	30	200
		31	....

Daily discharge, in second-feet, of West Fork of Hood River near Dee, Oreg., for the years ending Sept. 30, 1913, 1914, and 1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	May.	June.	July.	Aug.	Sept.
1914.										
1	200	315	....	336	....	....	490	336	220	150
2	195	268	....	343	....	....	....	336	215	150
3	195	268	....	350	....	....	510	336	220	154
4	195	256	....	....	....	....	470	336	215	154
5	200	350	480	....	....	....	440	308	210	150
6	226	....	430	....	....	....	430	294	210	150
7	....	....	430	....	530	....	....	294	215	166
8	470	....	414	....	530	....	....	294	210	166
9	510	....	390	....	480	....	....	287	200	180
10	530	....	366	....	470	....	....	287	195	150
11	....	470	398	....	470	....	490	294	195	162
12	450	430	414	....	....	....	480	308	200	195
13	....	414	366	....	....	....	480	294	200	170
14	....	366	390	....	510	....	430	274	200	280
15	....	350	382	....	490	....	422	280	210	520
16	....	358	366	....	480	....	414	274	200	350
17	520	382	350	....	430	....	398	256	175	390
18	430	358	350	....	422	....	382	280	175	336
19	414	390	343	520	414	....	358	268	170	430
20	366	390	336	490	414	....	350	268	170	450
21	358	398	315	....	450	....	382	226	175	343
22	343	414	336	....	....	....	358	220	180	308
23	322	....	308	....	....	....	350	220	170	280
24	336	....	280	....	....	....	366	220	166	256
25	294	....	308	....	....	....	366	220	166	244
26	287	....	315	....	....	....	358	220	170	250
27	268	....	294	....	....	....	350	220	170	274
28	256	....	315	....	....	....	350	215	166	232
29	256	....	287	....	....	530	343	215	170	226
30	244	....	287	....	....	510	336	215	166	220
31	256	....	336	....	....	510	....	220	154	....

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915.									
1	390	366	530	....	414	414	250	170	150
2	390	366	530	....	390	390	250	170	150
3	390	414	530	....	390	366	250	170	138
4	366	390	....	....	366	366	250	170	130
5	366	366	....	....	366	350	250	170	130
6	366	390	....	....	366	336	250	170	130
7	350	390	....	....	350	315	280	170	130
8	336	366	....	....	350	315	268	170	130
9	336	366	530	....	366	294	280	170	124
10	336	366	530	....	450	280	232	170	124
11	315	366	530	....	480	280	210	162	115
12	294	350	530	....	480	280	210	162	124
13	294	350	....	....	450	280	210	162	124
14	....	336	....	....	430	280	220	162	124
15	....	336	....	....	430	280	220	162	115
16	....	336	....	....	430	280	220	162	115
17	450	336	....	....	430	280	294	162	115
18	430	430	....	....	430	280	280	162	115
19	414	414	....	....	430	280	268	162	115
20	350	414	....	....	430	280	268	162	115
21	336	414	....	530	430	280	250	162	106
22	336	414	....	530	430	280	250	162	106
23	336	414	....	....	430	268	232	162	106
24	315	....	....	....	430	268	232	162	106
25	315	....	....	480	414	268	220	162	106
26	336	....	....	480	414	315	210	162	106
27	280	....	....	450	414	294	180	162	106
28	280	530	....	450	....	280	170	162	100
29	280	....	....	430	530	268	170	162	100
30	268	....	....	430	480	250	170	162	100
31	315	....	....	....	430	....	170	162	....

NOTE.—Daily discharge determined from a well-defined rating curve. On days for which discharge is not given the flow exceeded 530 second-feet.

ON RIVER BASIN.

SH DAM, NEAR TROUT LAKE, WASH.

, R. 11 E., at splash dam formerly used by south of Trout Lake, Klickitat County, 4 nd about 10 miles north of Husum.

eptember 30, 1915.

e the dam, except June 1 to September 30, during which periods gage readings were k just below dam. Gage read twice daily

a cable 800 feet below the dam.

bove the dam the control is formed by two pening; below the dam, rocks and gravel;

tage recorded during year, 7.65 feet at 7 d-feet); minimum stage recorded, 1.05 feet cond-feet).

not affected by ice.

f water is diverted for irrigation above the

hed by Northwestern Electric Co.

iver at splash dam, near Trout Lake, Wash., ding Sept. 30, 1915.

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	2.37	197
	1.65	132
	1.44	82.6

Daily discharge, in second-feet, of White Salmon River at splash dam, near Trout Lake. Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	198	385	360	275	220	255	1,210	575	385	95	55	56
2	235	545	360	255	212	255	1,990	545	360	105	63	56
3	255	890	360	235	205	275	2,140	515	295	115	67	56
4	220	850	335	235	198	315	1,890	515	255	115	55	63
5	212	670	335	235	205	315	1,490	515	235	115	55	80
6	250	670	315	235	198	295	1,170	515	235	110	59	71
7	198	545	315	235	198	295	1,170	515	220	110	59	71
8	190	485	295	235	198	295	1,290	515	198	126	63	80
9	190	460	295	235	205	295	1,130	605	182	126	59	71
10	235	410	275	220	205	295	1,090	705	168	100	67	71
11	255	460	275	220	198	295	1,050	705	168	95	76	71
12	315	575	235	220	190	295	1,090	635	175	95	76	71
13	275	1,050	255	235	190	315	1,000	575	175	90	71	71
14	235	1,010	255	235	190	515	1,010	515	152	95	71	75
15	235	740	295	235	190	670	970	460	132	95	67	75
16	220	635	315	220	190	705	1,050	410	132	95	63	80
17	235	545	315	220	198	670	1,090	545	126	105	59	75
18	315	515	275	220	212	705	1,170	545	115	100	63	75
19	740	360	275	220	205	635	1,170	515	110	100	67	75
20	670	485	198	212	205	635	1,170	515	115	100	67	71
21	545	460	220	235	205	670	1,010	460	105	105	59	71
22	460	460	220	198	205	740	930	435	105	105	59	71
23	385	460	220	205	205	810	850	410	105	95	59	71
24	360	460	235	212	255	890	810	460	110	90	59	67
25	315	435	275	190	335	810	810	460	105	90	56	67
26	315	410	235	190	295	740	740	460	100	85	59	67
27	275	410	235	198	275	670	740	460	105	80	59	63
28	275	435	235	168	255	670	705	635	95	80	63	63
29	255	410	220	190	....	740	710	515	85	71	67	67
30	275	385	235	198	....	810	635	435	95	59	71	67
31	315	....	255	205	....	810	....	410	....	63	63	....

NOTE.—Discharge determined as follows: Oct. 1, 1914, to Aug. 9, 1915, from a rating curve well defined between 150 and 800 second-feet; Aug. 10–21, by indirect method for shifting control; Aug. 22 to Sept. 30, from a fairly well-defined rating curve; Dec. 22–23, estimated, on account of ice.

Monthly discharge of White Salmon River at splash dam, near Trout Lake, Wash., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	740	190	303	18,600	A.
November	1,050	360	554	33,000	A.
December	360	198	275	16,900	A.
January	275	168	220	13,500	A.
February	335	190	216	12,000	A.
March	890	255	538	33,100	A.
April	2,140	635	1,110	66,000	B.
May	705	410	519	31,900	B.
June	385	85	165	9,820	B.
July	126	59	97.1	5,970	B.
August	76	55	63.1	3,880	B.
September	80	56	69.6	4,140	B.
The year	2,140	55	344	248,000	

WHITE SALMON RIVER AT HUSUM, WASH.

LOCATION.—In the SE. ¼ sec. 25, T. 4 N., R. 10 E., 1,000 feet above falls and power house at Husum, Klickitat County, and three-fourths mile above Rattlesnake Creek.

DRAINAGE AREA.—300 square miles.

RECORDS AVAILABLE.—September 23, 1909, to September 30, 1915.

GAGE.—Vertical staff on right bank; read daily by John Wassell. Fuller water-stage recorder used October, 1912, to February, 1915.

cable 100 feet below gage.
va boulders; practically permanent. Con-
nes obstructed by logs, causing backwater.
ge recorded during year, 5.6 feet at 11 a. m.
minimum stage recorded, 2.66 feet at 2 p. m.
-feet).
d, 7.65 feet at 7 a. m. November 24, 1909
num stage recorded, 2.66 feet at 2 p. m.
second-feet).
practically unaffected by ice.
er for irrigation in Trout Lake Valley.
ected at times by operation of splash dam
ream at present.
ome uncertainty owing to diurnal fluctua-
nd gaps in gage-height record.

River at Husum, Wash., during the year
t. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 25	C. L. Batchelder.......	3.05	625
Sept. 18	......do................	2.86	507

almon River at Husum, Wash., for the year
ot. 30, 1915.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
820	1,470	1,080	970	675	540	540
870	2,100	1,080	920	720	540	540
820	2,260	1,020	870	675	630	540
970	2,100	1,020	870	675	585	540
870	1,620	1,020	870	675	540	540
770	1,620	1,020	870	675	540	540
770	1,620	1,020	820	675	540	540
770	1,540	1,020	820	675	540	540
770	1,470	1,080	770	675	540	540
770	1,400	1,140	770	675	540	540
770	1,400	1,140	770	675	585	540
770	1,400	1,140	770	675	630	495
770	1,400	1,080	770	675	540	495
970	1,330	1,020	720	630	585	495
970	1,260	970	720	630	585	540
1,140	1,330	970	720	630	540	540
1,400	1,330	1,400	720	675	540	540
1,620	1,330	1,080	720	630	585	495
1,400	1,330	1,080	720	630	540	495
1,400	1,470	1,020	720	630	585	495
1,620	1,470	1,020	720	630	585	495
1,400	1,330	970	675	630	585	495
1,200	1,200	970	675	630	585	495
1,260	1,200	970	720	585	540	495
1,200	1,200	970	675	585	540	495
1,140	1,200	970	675	585	540	450
1,080	1,200	970	675	585	540	450
1,080	1,140	1,080	675	585	585	450
1,080	1,140	1,080	675	585	540	450
1,200	1,080	970	720	540	540	450
1,200	....	970	....	540	540	....

ve well defined below and fairly well defined above
30, Nov. 16–20, 22–27, Dec. 8–10, 13–18, 20–25, Dec. 27
-12.

..bo.
, Dec. 27

Monthly discharge of White Salmon River at Husum, Wash., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	1,020	630	712	43,800	B.
November	1,320	720	883	52,500	B.
December	770	585	628	38,600	C.
January	630	495	590	36,300	B.
February	870	555	642	35,700	B.
March	1,620	770	1,060	65,200	B.
April	2,260	1,080	1,430	85,100	B.
May	1,400	970	1,040	64,000	B.
June	970	675	760	45,200	A.
July	720	540	637	39,200	A.
August	630	540	560	34,400	A.
September	540	450	508	30,200	A.
The year	2,260	450	788	570,000	

SANDY RIVER BASIN.

SANDY RIVER NEAR MARMOT, OREG.

Location.—In sec. 24, T. 2 S., R. 5 E., at the Van der Hoof ranch, about 1½ miles south of Marmot, Clackamas County, 2 miles by river above the Sandy River dam of the Portland Railway, Light & Power Co., and about 5 miles below the mouth of Salmon River.

Drainage area.—267 square miles (measured on topographic maps and Forest Service map).

Records available.—August 15, 1911, to September 30, 1915.

Gage.—Friez water-stage recorder on right bank, referred to a vertical staff on the stilling well. Observer, A. D. Cahill.

Discharge measurements.—Made from cable about a mile below gage, just within the backwater of the dam.

Channel and control.—Rocks and gravel; may shift slightly.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 5.00 feet at 10 a. m. November 13 (discharge, 4,000 second-feet); minimum stage from water-stage recorder, 0.95 foot at 4 p. m. September 29 and 30 (discharge, 285 second-feet).

1911–1915: Maximum stage recorded, 9.25 feet January 13, 1912 (discharge, 12,700 second-feet); minimum stage is that of 1915.

Winter flow.—Stage-discharge relation practically unaffected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered excellent.

Discharge measurements of Sandy River near Marmot, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 15	P. V. Hodges	2.48	1,060
Apr. 1	Batchelder and Kelley	3.58	2,020
Aug. 12	C. L. Batchelder	1.32	406

River near Marmot, Oreg., for the year ending 30, 1915.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
40	1,150	1,990	730	1,570	700	500	377
70	1,080	2,380	700	1,480	675	525	365
10	1,010	2,630	730	1,310	650	500	352
90	1,520	2,320	730	1,190	650	450	340
70	1,480	1,940	675	1,080	625	460	327
10	1,270	1,700	675	1,010	675	465	315
90	1,150	1,700	675	975	700	446	312
20	1,080	1,520	650	910	760	426	330
50	1,010	1,350	730	880	760	434	318
20	1,010	1,310	940	910	650	450	318
40	975	1,270	940	1,310	600	450	309
75	975	1,230	1,010	1,390	575	434	366
10	1,120	1,270	1,080	1,150	575	402	438
50	1,700	1,190	1,080	1,040	730	394	398
20	2,150	1,080	1,010	940	675	394	342
20	1,890	1,120	940	880	790	406	334
75	1,800	1,080	1,120	880	1,080	390	324
30	1,750	1,080	1,390	820	880	382	318
20	1,570	1,040	1,750	880	760	390	312
40	1,480	1,010	1,620	850	730	402	312
10	1,570	910	1,440	760	700	402	315
75	1,660	880	1,350	760	650	402	309
75	1,750	880	1,310	760	600	406	300
70	1,660	850	1,350	730	575	390	300
80	1,440	820	1,310	730	550	390	300
10	1,270	790	1,570	940	550	402	300
70	1,150	760	1,660	820	525	390	324
70	1,270	730	2,380	730	525	386	297
...	1,570	790	1,940	700	525	386	294
...	1,660	730	1,570	675	525	402	294
...	1,570	....	1,390	....	525	389	....

ve well defined between 300 and 8,000 second-feet. Ice in record of stage Dec. 16 to Jan. 11; discharge for this Apr. 11 and Sept. 1-5.

Marmot, Oreg., for the year ending Sept. 30, 1915.

, 267 square miles.]

n second-feet.			Run-off.		Accuracy.
m.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
60	897	3.36	3.87	55,200	A.
90	1,320	4.94	5.51	78,600	A.
25	715	2.68	3.09	44,000	B.
25	1,050	3.93	4.53	64,600	B.
20	1,130	4.23	4.40	62,800	A.
75	1,410	5.28	6.09	86,700	A.
30	1,280	4.79	5.34	76,200	A.
50	1,180	4.42	5.10	72,600	A.
75	969	3.63	4.05	57,700	A.
25	661	2.48	2.86	40,600	A.
82	421	1.58	1.82	25,900	A.
94	328	1.23	1,37	19,500	A.
94	945	3.54	48.03	684,000	

CLEAR FORK OF SANDY RIVER NEAR WELCHES, OREG.

Location.—In the SW. ¼ sec. 19, T. 2 S., R. 8 E., 100 yards below Clear Fork ranger cabin, about half a mile above the mouth of stream and about 7 miles northeast of Welches, Clackamas County.

Drainage area.—Not measured.

Records available.—August 15 to October 15, 1913; July 18 to September 18, 1914; July 2 to September 20, 1915, when station was discontinued.

Gage.—Vertical staff on left bank. Gage reader, E. W. Schmeer.

Discharge measurements.—Made by wading.

Channel and control.—Gravel and boulders; practically permanent.

Extremes of discharge.—Maximum stage recorded during period July 2 to September 20, 1915, 0.65 foot July 19 (discharge, 31 second-feet); minimum stage recorded, 0.20 foot September 20 (discharge, 6 second-feet).

1913–1915: Minimum stage recorded, 0.20 foot September 2 and 4, 1914, and September 20, 1915 (discharge, 6 second-feet). No records during winter flood periods.

Winter flow.—No records

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered good.

Discharge measurements of Clear Fork of Sandy River near Welches, Oreg., during the year ending Sept. 30, 1915.

[Made by C. L. Batchelder.]

Date.	Gage height.	Discharge.
	Foot.	*Sec.-ft.*
Aug. 15	0.31	11.5
Sept. 8	.26	9.2

Daily discharge, in second-feet, of Clear Fork of Sandy River near Welches, Oreg., for the year ending Sept. 30, 1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1				11				21			
2	24	17	8	12	19			22			
3				13				23			
4				14		12		24	24		
5			8	15		12	11	25		8	
6	23			16	25			26			
7		15		17		12		27	21		
8			9	18				28		8	
9		14		19	31			29			
10	23			20		10	6	30			
								31	19	8	

Note.—Discharge determined from a well-defined rating curve; given only for days on which gage was read.

LOST CREEK NEAR BRIGHTWOOD, OREG.

Location.—In the NE. ¼ sec. 25, T. 2 S., R. 7 E., about 100 yards above mouth, a mile southeast of Truman's ranch, and about 8 miles east of Brightwood, Clackamas County.

Drainage area.—11.2 square miles (measured on topographic map).

Records available.—September 17, 1913, to September 30, 1915.

erred to a vertical staff on left bank. Gage

foot log or by wading.
ulders; may shift in floods.
age during year from water-stage recorder,
(discharge, 208 second-feet); minimum stage
September 25 (discharge, 15 second-feet).
et at 10 a. m. January 5, 1914 (discharge,
curred in 1915.
unaffected by ice.

t except during extremely high water.

Brightwood, Oreg., during the year ending Sept. 1915.

Date.	Made by—	Gage height.	Dis-charge.
		Feet.	*Sec.-ft.*
Mar. 31	Kelley and Batchelder.	1.30	98.3
Aug. 15	C. L. Batchelder.......	.48	18.8
Sept. 8	....do..........	.42	15.3

k near Brightwood, Oreg., for the year ending 30, 1915.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	179	37	84	32	23	15
....	182	36	75	31	22	16
....	176	35	67	30	21	15
....	140	36	60	29	20	15
....	114	37	57	29	20	15
....	100	40	51	34	19	15
....	102	43	47	31	19	15
....	87	42	42	36	18	15
....	78	48	40	32	18	15
....	77	66	41	29	18	15
....	78	63	58	27	18	15
....	82	64	69	26	18	18
....	77	66	54	27	18	24
....	66	69	46	33	18	19
....	58	64	44	31	17	18
....	61	60	42	36	17	17
....	67	67	41	42	17	16
....	66	87	39	36	17	16
....	64	120	40	33	17	15
....	61	112	40	31	16	15
....	51	96	36	29	16	15
....	48	87	35	27	16	15
....	46	82	34	26	16	15
....	47	85	32	24	16	15
....	43	82	34	24	16	15
64	42	106	46	24	16	15
60	43	110	39	24	15	16
85	44	125	36	24	15	16
112	45	104	34	24	15	15
116	40	89	33	24	15	15
102	....	77	....	24	15	....

e well defined between 15 and 150 second-feet. Dis-
vith records of flow of Little Sandy River. Gage out

Monthly discharge of Lost Creek near Brightwood, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 11.2 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	148	29	62.4	5.57	6.42	3,840	A.
November	176	40	76.9	6.87	7.66	4,580	A.
December	40	24	31.6	2.82	3.25	1,940	A.
January	102	30	54.3	4.85	5.59	3,340	B.
February			[a] 90.0	8.04	8.37	5,000	
March			[a] 100	8.93	10.30	6,150	
April	182	40	78.8	7.04	7.86	4,690	A.
May	125	35	72.1	6.44	7.42	4,430	A.
June	84	32	46.5	4.15	4.63	2,770	A.
July	42	24	29.3	2.62	3.02	1,800	A.
August	23	15	17.5	1.56	1.80	1,080	A.
September	24	15	15.9	1.42	1.58	946	A.
The year	182	15	56.0	5.00	67.90	40,600	

[a] Mean discharge estimated by comparison with record of flow of Little Sandy River; roughly approximate.

BULL RUN RIVER NEAR BULL RUN, OREG.

Location.—In sec. 25, T. 1 S., R. 5 E., 1¼ miles above intake of Portland water-supply pipe line, and 5 miles east of Bull Run, Clackamas County.

Drainage area.—102 square miles.

Records available.—August 20, 1907, to September 30, 1915; also readings on a gage installed by city water department, January 5, 1895, to November 13, 1906.

Gage.—Friez water-stage recorder referred to vertical staff on left bank. Prior to July 28, 1909, an inclined staff at headworks 1¼ miles below present gage. Gage readers, gatemen at headworks.

Discharge measurements.—Made from cable at gage or by wading near gage.

Channel and control.—Rocks and gravel; shifting in extreme floods.

Extremes of discharge.—Maximum stage, estimated by comparison with readings on staff gage at headworks, 6.80 feet at 1 p. m. November 13 (discharge, 3,400 second-feet). Minimum stage from water-stage recorder, 2.55 feet September 25 (discharge, 74 second-feet).

1895–1915: Maximum stage recorded, 10.6 feet on gage at headworks November 13, 1906 (discharge, 15,400 second-feet); minimum stage recorded, 2.54 feet August 29 to September 4, 1914 (discharge, 72 second-feet) and 2.60 feet September 3 to 4, 1910 (discharge, 72 second-feet).

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None above station. The two water-supply pipes divert practically all the low-water flow 1¼ miles below the station.

Regulation.—None.

Accuracy.—Results excellent except for extremely high stages, for which they are somewhat uncertain.

Discharge measurements of Bull Run River near Bull Run, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	F. F. Henshaw	3.67	460	Aug. 31	C. L. Batchelder	2.62	95.8
Aug. 13	C. L. Batchelder	2.77	125	31	do	2.62	91.7

ın River near Bull Run, Oreg., for the year ot. 30., 1915.

.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
0	644	1,360	215	655	285	215	91
0	567	1,460	212	556	263	207	90
5	515	1,640	203	478	246	198	88
7	817	1,460	200	425	237	190	87
5	739	1,040	194	380	221	181	88
0	650	817	191	346	256	173	89
4	588	799	185	318	277	164	90
9	525	695	182	299	402	159	91
6	483	583	188	285	342	153	92
4	483	515	326	299	299	148	90
1	449	494	351	483	274	143	84
9	439	515	384	515	256	137	90
9	509	551	435	449	263	132	112
6	965	483	515	398	412	126	115
9	1,110	435	494	359	384	124	102
6	853	416	425	334	660	122	97
5	787	389	530	322	865	120	92
9	787	367	793	307	660	118	87
8	661	346	1,260	449	520	116	86
5	616	326	986	420	425	114	84
5	622	307	823	372	372	112	82
6	633	292	745	346	326	110	80
8	639	307	695	267	299	107	78
0	588	281	711	318	277	104	76
0	499	263	700	330	256	101	74
3	439	237	1,150	509	243	98	74
7	407	230	1,360	425	237	95	74
3	439	218	1,730	367	230	92	74
..	622	250	1,150	334	227	92	74
..	793	218	865	307	221	92	74
..	723	....	706	....	224	92	....

l-defined rating curve. Discharge Nov. 1–6 and 8–13 ks and is somewhat doubtful owing to uncertainty as charge estimated Dec. 20–24, as float was frozen in well. 20, 22–27, 29–30, Sept. 1–3, 4–8, 19–24, and 26–30; recorder

Bull Run, Oreg., for the year ending Sept. 30, 915.

102 square miles.]

second-feet.			Run-off.		
.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
1	607	5.95	6.86	37,300	A.
5	903	8.85	9.87	53,700	C.
8	366	3.59	4.14	22,500	B.
5	781	7.66	8.83	48,000	A.
6	719	7.05	7.34	39,900	A.
7	632	6.20	7.15	38,900	A.
8	576	5.65	6.30	34,300	A.
2	610	5.98	6.89	37,500	A.
7	388	3.80	4.24	23,100	A.
1	337	3.30	3.80	20,700	A.
2	133	1.30	1.50	8,180	B.
4	86.8	.85	.95	5,160	B.
4	510	5.02	67.90	369,000	

R NEAR MARMOT, OREG.

R. 6 E., at trail bridge at Little Sandy ranger
, Clackamas County.
easured on topographic map).
to September 30, 1915.

Gage.—Stevens water-stage recorder referred to vertical staff on left bank just below bridge. Gage reader, Carl Aschoff.

Discharge measurements.—Made from trail bridge or by wading.

Channel and control.—Gravel and boulders; may shift somewhat.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 2.56 feet at 2 a. m., November 13 (discharge, 514 second-feet); minimum stage from water-stage recorder, 0.27 foot September 24 and 25 (discharge, 12 second-feet).

1913–1915: Maximum stage recorded, 3.22 feet, January 5, 1914 (discharge, 934 second-feet); minimum stage recorded, 0.21 foot August 28, 1914 (discharge, 12 second-feet).

Winter flow.—Stage-discharge relation never affected by ice.

Diversions.—None above station.

Regulation.—None.

Accuracy.—Results considered excellent except for periods during which stage was extremely high or recorder was not working properly.

Discharge measurements of Little Sandy River near Marmot, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	F. F. Henshaw	1.04	59.1	Mar. 30	Batchelder and Kelley	1.97	260
Nov. 6	P. V. Hodges	1.60	148	Apr. 1	.....do	2.25	376
Dec. 3	.....do	.89	56.0	July 5	Henshaw and Batchelder	.70	36.4
Jan. 11	.....do	1.56	155	Aug. 13	C. L. Batchelder	.44	20.0
Mar. 30	Batchelder and Kelley	1.92	236				

Daily discharge, in second-feet, of Little Sandy River near Marmot, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	35	80	53	228	216	122	288	38	143	48	36	14
2	250	200	52	180	161	109	270	40	114	44	32	14
3	210	400	51	141	175	105	342	40	94	40	31	13
4	180	300	49	117	146	175	270	36	81	37	29	13
5	140	200	47	103	175	154	188	32	71	36	27	13
6	100	144	44	104	175	131	150	31	63	48	25	13
7	61	154	42	114	150	112	150	30	57	54	24	13
8	52	124	40	389	133	101	126	29	52	85	23	13
9	51	95	40	216	128	89	104	37	52	78	22	13
10	73	66	38	173	114	98	92	80	62	64	22	13
11	68	180	36	156	96	89	89	90	152	56	21	13
12	63	240	33	135	82	89	96	90	175	52	20	15
13	58	418	32	204	76	112	103	107	128	51	20	23
14	53	270	32	350	66	194	88	130	104	104	20	19
15	48	188	32	294	62	194	74	109	88	86	19	16
16	48	143	26	194	64	183	69	90	78	121	18	14
17	60	126	27	148	117	172	64	143	82	188	17	14
18	200	109	28	135	135	161	61	213	74	126	17	14
19	350	94	29	130	106	150	57	335	148	98	16	13
20	280	89	29	119	92	138	52	231	117	78	15	13
21	170	90	28	106	88	126	48	175	94	65	15	13
22	82	94	28	94	90	114	46	150	82	47	15	13
23	76	80	28	83	96	102	54	135	76	50	15	12
24	70	70	29	73	202	90	51	143	72	45	15	12
25	64	62	29	65	219	79	48	135	74	41	15	12
26	58	60	94	64	166	68	42	237	106	39	15	12
27	52	59	81	58	154	70	40	257	83	38	15	18
28	46	58	170	55	148	102	37	354	66	40	14	16
29	40	56	121	53	....	135	38	231	59	40	14	14
30	40	54	170	51	....	180	39	166	53	39	14	13
31	55	....	166	76	....	152	....	133	....	40	14	....

Note.—Discharge determined from rating curves as follows: Oct. 1 to Nov. 13, well defined; Nov. 14 to Sept. 30, well defined above 15 second-feet. Discharge estimated from highest and lowest stages indicated by recorder and by comparative study of records of Bull Run River, as follows: Oct 1–6, 11–21, Oct. 23 to Nov. 5, Nov. 7–10, 21–24, Nov. 26 to Dec. 2, Dec. 4–7. Discharge interpolated Mar. 16–25, Aug. 14–20, Aug. 22 to Sept. 8, and Sept. 18–23.

ar Marmot, Oreg., for the year ending Sept. 30, 1915.

, 17.2 square miles.]

n second-feet.			Run-off.		Accuracy.
n.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
40	101	5.87	6.77	6,210	C.
54	143	8.31	9.27	8,510	B.
26	55.0	3.20	3.69	3,380	B.
51	142	8.26	9.52	8,730	A.
62	130	7.56	7.87	7,220	A.
68	126	7.33	8.45	7,750	A.
37	106	6.16	6.87	6,310	A.
29	131	7.62	8.78	8,060	A.
52	90.0	5.23	5.84	5,360	A.
36	63.8	3.71	4.28	3,920	A.
14	19.8	1.15	1.33	1,220	B.
12	14.0	.814	.91	833	B.
2	93.2	5.42	73.58	67,500	

RIVER BASIN.

TTE RIVER AT JASPER, OREG.

S., R. 2 W., just below Jasper post office, and 3 miles below Fall Creek.

905, to February 6, 1912; July 26, 1913, to

d daily. Gage reader, B. F. Sylvester.

new highway bridge a short distance above

nall boulders; shifting.

tage recorded, 6.8 feet at 8 a. m. January 14 mum stage recorded, 2.80 feet September 9) second-feet).

m stage recorded, 16.6 feet at 9 a. m. Novem- m extension of rating curve, 122,000 second- is that of 1915; a minimum of 530 second- is uncertain.

on Waldo Lake, but no storage operations

t.

Willamette River at Jasper, Oreg., during the Sept. 30, 1915.

P. V. Hodges.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	6.30	9,820
	2.85	653

Daily discharge, in second-feet, of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	860	1,300	1,680	1,620	3,420	3,420	2,500	1,890	3,680	1,300	860	645
2	1,020	1,680	1,820	2,210	9,300	3,170	2,600	1,820	3,680	1,190	860	680
3	3,170	1,680	2,500	1,960	9,300	2,820	3,170	1,820	3,170	1,190	860	680
4	1,960	1,550	2,120	2,210	8,300	2,930	3,680	1,750	2,710	1,190	860	645
5	1,620	1,420	1,820	2,120	6,480	3,680	3,420	1,680	2,500	1,080	860	610
6	1,420	1,820	1,750	1,960	5,660	3,420	1,960	1,620	2,300	1,080	810	610
7	1,240	1,680	1,750	2,040	4,920	2,930	2,930	1,550	2,120	1,550	760	645
8	1,190	1,550	1,680	3,680	4,260	2,710	2,500	1,550	2,040	1,360	760	610
9	1,360	1,420	1,680	4,920	3,680	2,500	2,500	1,680	1,960	1,620	760	610
10	1,300	1,420	1,550	3,680	3,420	2,400	2,300	1,960	1,820	1,480	760	610
11	1,420	1,300	1,550	3,170	3,170	2,210	2,300	2,600	2,040	1,300	760	610
12	1,360	1,360	1,420	2,820	2,710	2,120	2,500	2,500	2,500	1,190	760	610
13	1,300	1,550	1,420	1,960	2,500	2,210	2,120	2,930	2,300	1.190	760	680
14	1,190	3,170	1,300	12,600	2,300	1,960	3,170	4,260	1,960	1,190	760	760
15	1,190	2,930	1,240	10,400	2,120	2,120	2,820	4,920	1,890	1,190	760	720
16	1,080	2,210	1,190	6,060	2,040	2,220	2,600	3,680	1,820	1,080	760	680
17	1,190	2,040	1,190	4,260	2,040	2,040	2,500	3,420	1,680	1,190	760	680
18	1,620	1,960	1,140	3,680	2,500	3,550	2,600	5,660	1,680	1,080	760	645
19	4,260	1,820	1,190	3,680	2,710	2,120	2,710	8,300	1,620	1,080	720	610
20	4,260	1,680	1,190	3,680	2,600	1,960	2,710	6,480	1,550	1,020	720	610
21	3,680	1,550	1,080	3,680	2,710	2,710	2,710	5,660	1,480	970	680	610
22	3,170	1,550	1,080	3,170	2,500	2,930	2,500	6,480	1,420	970	680	610
23	2,500	1,480	1,080	2,710	2,600	3,170	2,120	5,660	1,420	970	680	610
24	2,120	1,420	1,080	2,500	2,820	3,420	2,040	6,480	1,420	970	680	645
25	1,960	1,360	1,080	2,300	3,170	3,170	1,890	6,480	1,480	920	680	645
26	1,680	1,300	1,140	2,120	2,930	2,820	1,820	6,480	1,550	860	680	610
27	1,620	1,300	1,480	1,960	2,820	2,500	1,820	6,480	1,480	860	680	645
28	1,550	1,300	1,420	1,960	3,420	2,300	1,820	6,900	1,360	860	680	720
29	1,420	1,820	1,620	2,040	....	2,500	1,820	6,480	1,300	860	680	645
30	1,360	1,960	1,550	2,040	....	2,500	1,960	5,280	1,300	920	645	610
31	1,420	....	1,550	2,120	....	2,600	....	4,260	....	970	645	....

Note.—Discharge determined from a well-defined rating curve.

Monthly discharge of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 1,450 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	4,260	860	1,820	1.26	1.45	112,000	A.
November	3,170	1,300	1,690	1.17	1.30	101,000	A.
December	2,500	1,080	1,460	1.01	1.16	89,800	A.
January	12,600	1,620	3,400	2.34	2.70	209,000	A.
February	9,300	2,040	3,800	2.62	2.73	211,000	A.
March	3,680	1,960	2,680	1.85	2.13	165,000	A.
April	3,680	1,820	2,470	1.70	1.90	147,000	A.
May	8,300	1,550	4,150	2.86	3.30	255,000	A.
June	3,680	1,300	1,970	1.36	1.52	117,000	A.
July	1,620	860	1,120	.772	.89	68,900	A.
August	860	645	745	.514	.59	45,800	A.
September	760	610	643	.443	.49	38,300	A.
The year	12,600	610	2,150	1.48	20.16	1,560,000	

WILLAMETTE RIVER AT ALBANY, OREG.

Location.—In the SW. ¼ sec. 6, T. 11 S., R. 3 W., at the end of Broadalbin Street, Albany, Linn County, about half a mile above the Southern Pacific Railroad bridge (formerly Corvallis & Eastern) just below the mouth of Calapooya Creek, and 7 miles above Santiam River.

Drainage area.—4,860 square miles.

Records available.—November 24, 1878, to April 30, 1882, and January 21, 1892, to September 30, 1915; some fragmentary records 1883 to 1888.

ght bank.
Southern Pacific bridge.
gravel; control practically permanent.
gins to flow through a slough several hun-
el.

ge recorded during year, 13.9 feet at 8 a. m.
-feet); minimum stage recorded, 0.5 foot
cond-feet).
stage recorded, 32.8 feet January 14, 1881
mum stage recorded, 0.2 foot September
eet), but this is somewhat uncertain; lowest
foot October 30 to November 10, 1895 (dis-
ot August 26 to September 25, 1905, and
2,400 second-feet). The maximum stage
1861 (discharge, 302,000 second-feet).
has diverted water from South Santiam
ito Willamette River above the gage and
. The following measurements have been
)11, at Albany, 210 second feet; September
Albany, 242 second-feet; July 15, 1913, at
esenting run-off per square mile and depth
apers 312, 332, 362, 370, and 394, are in error.

ned by United States Weather Bureau.

s made by P. V. Hodges:
.58 foot; discharge, 2,640 second-feet.

River at Albany, Oreg., for the year ending
, 1915.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
13,500	10,300	5,730	13,800	4,810	3,530	2,580
12,900	10,000	6,690	12,300	4,580	3,530	2,580
12,300	11,200	6,450	11,800	4,580	3,530	2,580
11,500	12,600	6,450	10,900	4,360	3,530	2,580
12,000	13,200	6,210	10,000	4,360	3,530	2,400
12,600	12,300	6,210	9,220	4,360	3,530	2,400
12,000	11,500	5,970	8,430	4,360	3,330	2,400
11,200	11,200	5,730	7,920	5,040	3,330	2,400
10,600	10,600	5,730	7,670	5,040	3,140	2,400
10,000	10,000	5,970	7,420	5,500	3,140	2,400
9,490	9,490	6,930	7,170	5,270	3,140	2,400
9,220	9,220	8,950	7,420	5,040	2,950	2,400
8,950	9,220	8,950	8,430	4,580	2,950	2,400
9,490	8,950	9,490	7,920	4,360	2,950	2,400
11,200	10,300	11,500	7,420	4,360	2,950	2,760
11,800	9,760	13,800	7,170	4,360	2,950	2,950
12,000	9,220	12,300	6,690	4,150	2,950	2,760
11,500	9,220	11,500	6,450	4,150	2,950	2,760
12,000	8,950	14,700	6,210	4,150	2,950	2,580
11,500	8,950	20,400	6,210	4,150	2,950	2,580
10,600	8,690	18,400	6,210	3,940	2,950	2,580
10,300	8,690	15,900	5,970	3,940	2,950	2,580
10,000	8,170	16,500	5,500	3,940	2,950	2,580
10,600	7,920	15,900	5,500	3,730	2,760	2,580
10,600	7,420	16,200	5,270	3,730	2,760	2,580
10,300	7,170	16,500	5,270	3,730	2,760	2,580
9,490	6,930	16,500	5,500	3,530	2,760	2,580
8,950	6,930	17,500	5,500	3,530	2,760	2,580
8,690	6,690	18,700	5,270	3,530	2,760	2,580
9,490	6,450	17,800	5,040	3,530	2,760	2,580
9,760	....	15,900	....	3,530	2,760	....

ating curve.

Monthly discharge of Willamette River at Albany, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 4,860 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean		
October	18,700	3,730	6,970	429,000	A.
November	13,200	5,730	7,520	447,000	A.
December	15,300	5,040	9,630	592,000	A.
January	48,000	8,950	16,900	1,040,000	A.
February	27,800	9,490	14,800	822,000	A.
March	13,500	8,690	10,800	664,000	A.
April	13,200	6,450	9,370	558,000	A.
May	20,400	5,730	11,800	726,000	A.
June	13,800	5,040	7,520	447,000	A.
July	5,500	3,530	4,270	263,000	A.
August	3,530	2,760	3,060	188,000	A.
September	2,950	2,400	2,550	152,000	A.
The year	48,000	2,400	8,740	6,330,000	

WILLAMETTE RIVER AT SALEM, OREG.

Location.—In the NW. ¼ sec. 27, T. 7 S., R. 3 W., at the foot of Trade Street, Salem, Marion County, about a mile above mouth of Mill Creek.

Drainage area.—Not measured.

Records available.—January 1, 1892, to September 30, 1915. Records continuous through the summer low-water periods since 1904 only. Discharge records have been computed only for period beginning October 1, 1909.

Gage.—Vertical staff in four sections on Oregon Washington Railroad & Navigation Co. dock on right bank of a slough, near its mouth.

Discharge measurements.—Made from Southern Pacific bridge about one-half mile below gage. From 1910 to 1912, from highway bridge a short distance above the railroad bridge. Conditions favorable except for low velocities at low stages.

Channel and control.—Channel deep at bridge; overflows at high stages over left bank. Control of gravel and sand; somewhat shifting during floods.

Extremes of stage.—The maximum stages recorded each year, 1895 to 1915, are shown in the following table:

Maximum recorded stages of Willamette River at Salem, Oreg.

Year ending Sept. 30—	Day.	Hour.	Stage.	Discharge.
			Feet.	*Sec.-ft.*
1895	Jan. 14	8 a. m.	20.4	165,000
1896	Jan. 23	8 a. m.	21.3	176,000
1897	Feb. 17	8 a. m.	17.6	136,000
1898	Dec. 15	8 a. m.	17.7	137,000
1899	Mar. 3	8 a. m.	20.4	165,000
1900	Jan. 16	8 a. m.	21.5	178,000
1901	Jan. 15	5 p. m.	30.0	306,000
1902	Feb. 12	8 a. m.	16.2	122,000
1903	Jan. 27	8 a. m.	28.6	283,000
1904	Feb. 18	8 a. m.	19.5	155,000
1905	Dec. 31 Jan. 1	8 a. m.	15.3	113,000
1906	Feb. 26	8 a. m.	13.2	92,000
1907	Feb. 6	6 p. m.	31.1	325,000
1908	Dec. 7	1 p. m.	24.7	224,000
1909	Jan. 22	5 p. m.	22.0	185,000
1910	Nov. 25	8 a. m.	30.5	315,000
1911	Jan. 20	8 a. m.	19.5	155,000
1912	Jan. 15	8 a. m.	24.5	221,000
1913	Mar. 31	4 p. m.	19.8	158,000
1914	Jan. 25	8 a. m.	16.3	123,000
1915	Jan. 16	8 a. m.	13.2	92,000

Minimum stage recorded during period October 1, 1909, to September 30, 1915, −1.46 feet September 8, 1915 (discharge, 3,310 second-feet).

Maximum stage ever known, about 39 feet December 4, 1861 (discharge, estimated from an extension of rating curve as 500,000 second-feet). The flood of January 16, 1881, reached a stage of 36.3 feet (discharge, 428,000 second-feet),

n Santiam River near Stayton into Mill
n diverted into a power canal which dis-
flow past the gage may be more or less
nt too slight to be appreciable.

for October, 1909, uncertain, as channel
vember.
nited States Weather Bureau.

at Salem, Oreg., during the years ending
to 1915.

Date.	Made by—	Gage height.	Dis- charge
1913.		*Feet.*	*Sec.-ft.*
ug. 13–14	H. M. Nelson..........	*b*. 35	6,080
1914.			
une 17	P. V. Hodges..........	1.46	9,970
ug. 1	H. J. Dean.............	— .76	4,230
1915.			
n. 27–28	P. V. Hodges..........	3.18	17,100
pt. 9	.....do.................	—1.44	3,320

56, have been corrected, by use of a coefficient of
an in vertical.
p. 655, was evidently on United States Engineer
au gage.

River at Salem, Oreg., for the years ending
to 1915.

lar.	Apr.	May.	June.	July.	Aug.	Sept.
4,000	18,200	15,700	9,500	6,200	4,240	3,910
1,000	17,700	15,200	9,500	6,200	4,240	3,910
,000	21,200	14,700	9,120	6,200	4,240	3,910
,000	22,800	15,700	8,740	5,940	4,240	3,910
,000	21,700	18,200	8,380	5,700	4,240	3,910
1,000	21,700	18,200	8,020	5,700	4,070	3,910
,000	21,700	17,200	8,020	5,700	4,070	3,750
7,600	22,200	16,200	8,020	5,460	4,070	3,750
,000	24,000	16,200	7,680	5,460	4,070	3,750
,400	23,400	15,700	7,360	5,460	4,070	3,750
,600	24,600	19,700	7,360	5,220	4,070	3,750
,500	25,200	25,200	8,020	5,220	4,070	3,750
,500	24,000	22,800	8,740	5,220	4,070	3,750
7,900	23,400	20,700	8,020	5,220	4,070	3,750
7,900	22,200	18,200	7,680	5,220	4,070	3,750
,200	20,200	16,700	7,360	4,800	4,070	3,750
,100	19,700	15,700	7,040	4,800	3,910	3,750
,000	19,200	14,700	7,360	4,800	3,910	3,910
,400	19,700	13,700	7,360	4,800	3,910	3,910
,700	20,700	13,200	7,040	4,800	3,910	3,910
,800	21,200	12,300	7,360	4,800	3,910	3,910
,800	20,700	11,900	7,360	4,800	3,910	4,420
,000	19,700	11,900	8,020	4,800	3,910	4,420
,700	19,700	11,500	8,020	4,610	3,910	4,240
,200	20,200	11,500	7,680	4,610	3,910	4,240
7,600	20,700	11,500	7,360	4,610	3,910	4,070
,200	19,700	11,500	6,740	4,610	3,910	3,910
,400	18,200	11,100	6,740	4,420	3,910	3,750
,700	16,700	10,700	6,460	4,420	3,910	3,750
,200	15,700	10,300	6,460	4,420	3,910	3,750
,200	......	9,900	......	4,420	3,910	......

Daily discharge, in second-feet, of Willamette River at Salem, Oreg., for the years ending Sept. 30, 1910 to 1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1910-11.												
1	3,750	4,240	115,000	27,000	35,800	15,200	22,800	15,700	19,200	10,700	4,800	**3,750**
2	3,750	4,240	95,000	26,400	40,000	14,700	24,000	15,700	20,200	10,700	4,800	**3,750**
3	4,240	4,070	70,400	24,000	40,000	13,700	23,400	16,700	20,200	10,300	4,800	**3,750**
4	6,740	4,070	87,300	22,800	36,500	13,200	21,700	18,700	19,200	9,500	4,800	**4,070**
5	11,100	4,070	95,000	21,200	32,400	13,700	20,700	20,700	17,700	8,740	4,800	**4,610**
6	11,900	4,420	82,800	20,700	33,000	15,700	18,700	22,200	16,700	8,380	4,800	**5,700**
7	9,500	4,800	62,400	20,200	31,800	17,200	17,200	21,700	15,700	8,020	4,800	**10,700**
8	7,360	14,200	52,000	19,700	30,000	18,700	16,200	20,700	15,200	8,020	4,610	**9,500**
9	6,200	28,200	50,400	19,700	27,600	19,700	15,700	20,200	14,700	7,680	4,610	**7,360**
10	5,700	33,000	52,800	24,000	25,200	20,200	15,700	20,700	14,700	7,360	4,420	**6,200**
11	5,460	39,300	46,400	27,600	25,800	19,700	18,200	20,700	14,200	7,040	4,240	**6,740**
12	5,220	36,500	38,600	32,400	27,600	19,700	20,200	20,200	14,700	6,740	4,240	**6,200**
13	5,220	27,000	33,700	28,200	29,400	20,200	20,200	20,200	15,200	6,740	4,240	**5,940**
14	5,000	20,700	30,000	24,000	33,000	19,200	19,700	22,200	15,200	6,460	4,070	**5,460**
15	5,220	16,700	26,400	22,200	32,400	19,200	18,700	21,700	14,700	6,460	4,070	**5,460**
16	5,220	14,200	24,000	19,700	29,400	20,700	18,200	20,700	14,200	6,200	4,070	**5,220**
17	4,800	12,700	24,000	19,700	25,800	21,700	19,200	20,200	13,200	6,200	4,070	**6,740**
18	4,800	11,500	31,200	59,200	24,600	21,700	19,700	22,800	12,300	5,940	4,070	**7,040**
19	6,740	12,700	31,800	138,000	26,400	21,200	20,200	41,600	11,900	5,700	4,070	**6,460**
20	6,200	13,700	27,600	155,000	25,200	21,200	21,200	52,000	11,100	5,700	4,070	**5,940**
21	5,700	24,000	25,200	135,000	24,000	22,800	20,200	44,000	10,700	5,460	3,910	**5,460**
22	5,220	48,000	22,800	89,100	22,200	23,400	19,700	36,500	10,300	5,460	3,910	**5,220**
23	4,800	56,000	21,200	59,200	20,700	23,400	20,200	31,800	9,900	5,220	3,910	**5,000**
24	4,800	72,900	20,700	44,000	19,700	25,200	19,700	28,800	9,500	5,220	3,910	**4,800**
25	4,610	65,600	25,200	37,900	18,200	26,400	20,200	26,400	9,120	5,220	3,750	**4,800**
26	4,610	44,000	25,200	37,200	17,700	25,800	21,200	23,400	9,120	5,000	3,750	**4,800**
27	4,420	32,400	24,000	35,800	17,200	22,800	20,700	21,700	9,120	4,800	3,750	**5,220**
28	4,420	33,000	23,400	33,700	15,700	20,700	19,700	20,200	10,300	4,800	3,750	**8,380**
29	4,240	64,000	22,800	31,800	....	18,700	17,700	19,200	10,700	4,800	3,750	**8,020**
30	4,240	102,000	22,200	30,000	....	18,200	16,700	18,700	10,300	4,800	3,750	**7,040**
31	4,240	....	25,800	31,200	....	19,700	....	18,700	....	4,800	3,750	....
1911-12.												
1	6,460	4,420	17,200	30,000	56,000	39,200	19,000	25,600	31,900	14,100	5,700	**8,900**
2	6,200	4,420	15,700	27,600	48,000	34,700	18,400	36,100	26,800	15,100	5,700	**14,100**
3	6,740	4,420	14,700	23,400	40,800	31,200	18,400	45,600	24,400	14,600	5,700	**14,100**
4	8,380	4,420	14,200	21,700	35,400	28,000	19,000	40,800	22,600	14,600	5,700	**15,600**
5	9,120	4,240	13,700	20,700	36,100	25,600	18,400	33,300	20,800	14,100	5,240	**14,100**
6	9,120	4,240	14,700	26,400	38,400	24,400	17,800	31,200	19,600	13,100	5,240	**12,100**
7	8,020	7,040	20,200	54,400	36,800	25,000	16,600	29,200	19,600	12,100	5,240	**11,200**
8	7,360	16,700	20,200	97,000	36,100	25,600	16.600	28,000	19,600	11,600	5,240	**12,100**
9	6,740	26,400	18,700	102,000	36,100	25,000	16,600	27,400	19,000	11,200	5,240	**17,200**
10	6,200	31,200	18,200	104,000	46,400	24,000	19,600	28,000	17,800	10,400	5,460	**17,800**
11	6,740	25,800	18,200	97,000	56,800	22,600	20,200	26,800	16,100	10,000	5,460	**15,100**
12	7,040	19,700	17,700	88,200	60,800	20,800	19,600	24,400	15,100	9,620	5,020	**12,100**
13	6,740	16,700	17,200	144,000	55,200	19,000	19,000	23,200	15,100	9,260	5,020	**10,400**
14	6,740	20,700	16,700	199,000	49,600	17,800	19,000	23,200	19,600	8,900	4,800	**9,620**
15	6,740	56,000	15,700	214,000	47,200	17,200	18,400	24,400	29,200	8,560	4,800	**8,560**
16	7,360	78,300	17,700	168,000	58,400	26,800	16,600	24,400	28,000	8,220	5,020	**7,600**
17	7,040	82,800	21,200	124,000	91,000	36,800	15,600	22,600	23,800	8,220	8,560	**7,020**
18	6,460	84,600	21,700	84,600	106,000	36,800	15,100	20,800	20,800	7,900	10,400	**7,020**
19	6,200	71,200	19,700	66,400	114,000	35,400	15,600	19,600	18,400	7,600	8,900	**6,740**
20	5,940	56,000	21,700	55,200	113,000	32,600	16,100	19,600	17,200	7,300	7,600	**6,200**
21	5,700	43,200	24,600	48,800	83,700	29,200	15,600	20,800	17,800	7,020	6,740	**5,940**
22	5,460	36,500	22,800	44,000	61,600	25,600	15,100	22,000	23,800	7,020	5,940	**5,700**
23	5,220	31,200	21,700	39,200	53,600	23,200	15,100	19,600	23,200	7,020	5,700	**5,460**
24	5,220	27,000	27,600	36,800	53,600	22,000	14,600	18,400	20,200	7,020	5,460	**5,460**
25	5,000	22,800	28,200	42,400	48,000	21,400	16,100	17,200	19,000	7,020	5,460	**5,460**
26	5,000	21,200	25,800	67,200	41,600	20,800	18,400	16,100	17,800	6,740	5,240	**5,240**
27	4,800	24,000	24,000	74,700	40,000	20,200	19,000	19,600	16,600	6,740	5,020	**5,240**
28	4,800	22,200	30,600	73,800	44,800	19,600	17,800	24,400	17,200	6,740	5,020	**5,020**
29	4,610	19,700	34,400	72,000	44,800	19,600	17,800	26,200	16,600	6,460	5,020	**5,020**
30	4,610	18,700	30,600	68,000	....	20,800	19,600	32,600	15,100	6,200	5,020	**5,020**
31	4,610	....	28,800	64,800	....	20,200	....	37,600	....	5,940	5,240	....

e River at Salem, Oreg., for the years ending
1915—Continued.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
15,100	151,000	22,800	22,800	23,400	7,360	4,800
14,100	145,100	21,200	24,000	24,000	7,360	4,800
15,100	112,000	20,200	25,200	22,800	7,040	5,460
18,400	75,600	19,700	25,200	21,700	7,040	6,740
20,800	68,000	18,700	23,400	25,200	6,740	13,700
22,000	77,400	18,700	21,700	25,200	6,460	11,900
22,600	76,500	20,700	19,700	22,800	6,200	8,740
23,200	66,400	24,600	19,200	20,700	6,200	7,360
25,000	57,600	27,000	19,200	18,700	5,940	6,460
25,600	49,600	28,800	18,700	17,700	5,940	6,200
26,200	44,000	30,000	17,700	16,700	5,940	5,940
25,600	44,000	32,400	16,700	15,200	5,940	5,700
23,800	43,200	30,600	15,700	14,200	5,940	5,460
22,000	42,400	28,200	15,700	13,700	5,940	5,220
20,800	37,900	25,800	16,200	12,700	5,940	5,000
19,000	35,100	25,800	15,700	11,900	5,940	4,800
19,000	33,000	27,600	14,700	11,500	5,700	4,800
20,200	30,600	28,800	13,700	11,100	5,700	4,800
25,600	31,800	35,100	13,700	10,700	5,700	4,420
29,200	31,800	35,100	15,200	10,300	5,700	4,420
28,000	30,000	31,200	16,700	9,900	5,460	4,240
25,600	31,200	28,800	17,200	9,500	5,460	4,240
24,400	30,600	27,600	25,800	9,500	5,220	4,240
23,800	28,200	28,200	33,700	9,120	5,220	4,240
22,600	25,800	28,800	31,200	9,120	5,220	4,240
20,800	25,800	28,200	35,800	8,740	5,000	4,240
19,600	27,600	27,600	32,400	8,740	5,000	4,240
19,000	27,600	28,200	27,600	8,380	4,800	4,240
25,600	25,800	27,000	28,800	8,020	4,800	4,240
88,200	24,000	25,200	26,400	7,680	4,800	4,420
35,000	....	22,800	....	7,360	4,800	....
77,400	25,600	17,800	11,000	7,480	4,360	3,510
84,600	25,000	16,800	10,600	7,200	4,360	3,510
77,400	23,800	16,800	10,600	6,920	4,210	3,510
66,400	24,400	16,800	10,200	6,920	4,210	3,510
66,400	26,800	16,300	10,200	6,660	4,060	3,510
70,400	28,000	15,300	10,200	6,400	4,060	3,510
70,400	25,600	14,800	11,400	6,160	4,060	3,510
53,200	23,200	14,800	16,300	6,160	3,920	3,780
54,400	22,600	15,300	19,300	5,920	3,920	4,210
47,300	24,400	16,300	18,300	5,920	3,920	4,700
41,700	31,000	15,800	15,800	5,920	3,920	4,360
37,500	34,000	14,800	13,800	5,920	3,780	4,210
34,700	32,200	14,300	13,000	5,700	3,780	4,060
32,800	33,400	14,300	12,600	5,700	3,780	4,060
31,000	35,400	14,300	11,800	5,480	3,780	4,060
29,200	52,000	14,300	11,000	5,480	3,780	8,400
28,000	57,600	14,300	10,600	5,280	3,640	11,800
26,800	48,800	13,000	9,820	5,280	3,640	15,300
25,600	39,600	12,600	9,440	5,080	3,640	14,300
25,000	35,400	12,200	9,080	4,880	3,610	19,300
3,800	32,800	11,800	8,740	4,880	3,640	17,800
2,600	29,200	11,400	8,400	4,880	3,640	13,800
1,400	26,800	11,800	8,080	4,880	3,640	11,000
0,800	25,000	12,600	8,080	4,880	3,640	8,740
0,300	23,200	13,000	9,440	4,880	3,640	7,480
9,300	22,000	13,400	10,600	4,700	3,640	6,920
8,300	20,800	13,400	9,440	4,520	3,640	6,400
8,300	20,300	13,000	8,740	4,360	3,510	6,400
8,300	19,800	13,000	8,080	4,360	3,510	6,400
9,800	18,800	12,200	7,780	4,360	3,510	5,920
2,600	....	11,400	....	4,360	3,510	....

Daily discharge, in second-feet, of Willamette River at Salem, Oreg., for the year ending Sept. 30, 1910 to 1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	5,700	10,600	25,000	19,300	19,300	25,000	19,300	10,200	26,200	6,660	4,700	3,510
2	5,700	11,400	23,800	26,200	40,300	24,400	20,300	10,200	24,400	6,400	4,700	3,510
3	7,780	15,300	24,400	26,800	50,400	22,000	22,600	9,440	22,000	6,400	4,700	3,510
4	13,400	18,800	26,800	25,000	51,200	20,800	26,200	9,440	19,300	6,160	4,520	3,510
5	13,800	16,800	25,000	23,200	52,000	22,000	26,800	9,080	17,800	5,920	4,520	3,510
6	11,000	15,800	22,000	23,800	46,600	23,200	24,400	9,080	15,800	5,920	4,360	3,510
7	9,440	17,300	20,300	22,600	40,300	22,000	22,000	8,740	14,300	6,160	4,360	3,510
8	8,400	15,800	19,300	25,000	35,400	20,300	20,800	8,400	13.400	6,920	4,360	3,310
9	7,480	14,300	25,000	41.000	32,200	18,800	19,800	8,400	12,600	7,480	4,210	3,330
10	7,480	12,600	26,200	44,500	28,600	17,800	18,300	8,400	11,800	8,080	4,210	3,510
11	7,480	11,800	23,200	38,900	26,800	17,300	16,800	11,000	11,400	7,480	4,060	3,510
12	9,080	11,000	20,300	37,500	23,800	16,300	16,300	14,800	12,200	6,920	4,060	3,510
13	9,440	13,800	19,300	37,500	22,000	15,800	16,300	16,800	13,800	6,660	4,060	3,510
14	9,080	29,200	15,800	51,200	20,300	16,800	18,300	16,800	13,400	6,400	4,060	3,510
15	8,400	31,000	14,300	85,500	18,800	20,800	18,300	20,300	12,200	6,400	3,920	3,510
16	7,480	27,400	13,000	92,000	17,300	24,400	17,300	24,400	11,400	6,160	3,920	3,510
17	7,480	23,200	11,800	68,800	16,800	23,800	16,300	22,600	10,600	6,160	3,920	3,640
18	8,740	20,300	11,000	50,400	17,300	22,600	15,300	20,800	10,200	5,920	3,920	3,640
19	11,800	17,800	10,200	40,300	19,300	23,200	15,300	25,000	9,440	6,400	3,920	3,640
20	34,000	16,800	9,820	36,100	20,300	21,400	14,300	34,700	9,080	5,920	3,920	3,510
21	41,700	15,800	9,440	32,800	20,300	19,300	14,300	34,000	8,740	5,700	3,780	3,510
22	31,000	13,800	9,080	30,400	20,800	18,800	13,800	29,800	8,400	5,700	3,780	3,510
23	23,800	13,400	8,400	26,800	20,800	19,300	13,000	29,200	8,080	5,480	3,780	3,510
24	19,300	12,600	7,780	23,800	22,600	19,800	12,600	28,600	7,780	5,280	3,780	3,510
25	15,800	11,800	7,480	21,400	25,000	19,300	11,800	28,600	7,480	5,080	3.780	3,380
26	14,300	11,400	6,660	19,300	26,800	18,300	11,400	29,800	7,480	4,880	3,640	3,380
27	12,200	10,600	18,800	18,300	25,000	16,800	10,600	32,200	7,480	4,880	3,640	3,380
28	11,000	10,200	19,800	17,300	24,400	15,300	10,200	33,400	8,080	4,880	3,640	3,380
29	10,200	14,800	21,400	16,300	....	14,800	10,200	37,500	7,480	4,880	3,640	3,640
30	9,440	21,400	20,300	15,800	....	16,800	9,820	34,000	6,920	4,880	3,640	3,640
31	9,080	....	19,800	15,800	....	18,800	....	30,400	....	4,700	3,510	....

NOTE.—Discharge determined from rating curves as follows: Oct. 1, 1909, to Jan. 15, 1912, and Apr. 1, 1913, to Jan. 25, 1914, fairly well defined; Jan. 16, 1912, to Mar. 31, 1913, well defined between 5,000 and 25,000 second-feet; Jan. 26, 1914, to Sept. 30, 1915, well defined between 3,200 and 30,000 second-feet and fairly well defined above 30,000 second-feet.

Monthly discharge of Willamette River at Salem, Oreg., for the years ending Sept. 30, 1910 to 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1909–10.					
October	8,020	4,420	5,560	342,000	C.
November	315,000	9,500	68,600	4,080,000	B.
December	105,000	16,700	46,000	2,830,000	B.
January	74,700	16,700	33,100	2,040,000	B.
February	85,500	22,200	43,900	2,440,000	B.
March	170,000	19,200	53,400	3,280,000	B.
April	25,200	15,700	20,900	1,240,000	B.
May	25,200	9,900	15,100	928,000	B.
June	9,500	6,460	7,750	461,000	B.
July	6,200	4,420	5,120	315,000	B.
August	4,240	3,910	4,020	247,000	B.
September	4,120	3,750	3,900	232,000	B.
The year	315,000	3,750	25,500	18,400,000	
1910–11.					
October	11,900	3,750	5,660	348,000	B.
November	102,000	4,070	28,400	1,690,000	B.
December	115,000	20,700	43,100	2,650,000	B.
January	155,000	19,700	42,500	2,610,000	B.
February	40,000	15,700	27,400	1,520,000	B.
March	26,400	13,200	19,800	1,220,000	B.
April	24,000	15,700	19,600	1,170,000	B.
May	52,000	15,700	24,000	1,480,000	B.
June	20,200	9,120	13,600	809,000	B.
July	10,700	4,800	6,710	413,000	B.
August	4,800	3,750	4,200	258,000	C.
September	10,700	3,750	5,980	356,000	B.
The year	155,000	3,750	20,100	14,500,000	

Oreg., for the years ending Sept. 30,
inued.

scharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
um.	Minimum.	Mean.		
120	4,610	6,330	389,000	B.
600	4,240	29,500	1,760,000	B.
400	13,700	21,100	1,300,000	B.
000	20,700	76,800	4,720,000	B.
000	35,400	56,300	3,240,000	B.
200	17,200	25,500	1,570,000	B.
200	14,600	17,500	1,040,000	B.
600	16,100	26,100	1,600,000	B.
900	15,100	20,400	1,210,000	B.
100	5,940	9,370	576,000	B.
400	4,800	5,800	357,000	B.
800	5,020	9,370	558,000	B.
000	4,240	25,200	18,300,000	
800	4,400	8,530	524,000	B.
000	12,100	40,200	2,390,000	B.
,700	13,600	28,700	1,760,000	B.
,000	32,600	55,500	3,410,000	B.
,600	16,100	23,900	1,330,000	B.
,000	14,100	27,900	1,720,000	B.
,000	24,000	51,000	3,030,000	B.
,100	18,700	26,600	1,640,000	B.
,800	13,700	21,700	1,290,000	B.
,200	7,360	14,400	885,000	B.
,360	4,800	5,820	358,000	B.
,700	4,240	5,640	336,000	B.
,000	4,240	25,800	18,700,000	
,800	4,240	11,600	713,000	B.
,000	6,460	20,400	1,210,000	B.
,400	11,500	20,000	1,230,000	B.
,000	25,800	61,300	3,770,000	B.
,700	23,200	38,700	2,150,000	B.
,600	18,300	39,200	2,410,000	B.
,600	18,800	29,600	1,760,000	B.
,800	11,400	14,100	867,000	B.
,300	7,780	11,100	660,000	B.
,480	4,360	5,530	340,000	B.
,360	3,510	3,810	234,000	B.
,300	3,510	7,270	433,000	B
,000	3,510	21,800	15,800,000	
1,700	5,700	12,900	793,000	B.
1,000	10,200	16,200	964,000	B.
6,800	6,660	17,300	1,060,000	B.
2,000	15,800	34,000	2,090,000	B.
2,000	16,800	28,000	1,560,000	B.
5,000	14,800	19,900	1,220,000	B.
6,800	9,820	16,800	1,000,000	B.
7,500	8,400	20,800	1,280,000	B.
6,200	6,920	12,300	732,000	B.
8,080	4,700	6,030	371,000	B.
4,700	3,510	4,030	248,000	B.
3,640	3,310	3,500	208,000	B.
2,000	3,310	15,900	11,500,000	

AKRIDGE, OREG.

R. 3 E., about a mile above Southern
akridge, Lane County.

September 30, 1915.
rder on right bank about a mile above
ght bank was read up to November 21,
tum, 300 feet below present site, used
4. Gage reader. Flora Warner.

Discharge measurements.—Made by wading or from bridge.

Channel and control.—Gravel and small boulders; shifting.

Extremes of discharge.—Maximum stage recorded during year, 1.94 feet at 8 a. m., October 19 (discharge, 872 second-feet); minimum stage recorded, 0. 38 foot September 25 (discharge, 117 second-feet); stage continued to fall until end of year.

1913–1915: Maximum stage recorded, 5.3 feet on original vertical staff March 30, 1913 (discharge, 2,500 second-feet); minimum stage recorded, 1.61 feet on inclined gage September 4 to 6, 1914 (discharge, 112 second-feet).

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None.

Regulations.—None.

Accuracy.—Results considered good except for higher stages, when recorder did not operate properly.

Discharge measurements of Salmon Creek near Oakridge, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 4	P. V. Hodges	1.50	562
June 25	C. L. Batchelder	.78	203
Sept. 23	P. V. Hodges	.39	119

Daily discharge, in second-feet, of Salmon Creek near Oakridge, Oreg., for year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	129	167	180	210	595	230	390	280	415	166	142	120
2	230	195	167	230	665	195	440	270	405	164	141	120
3	340	195	167	230	665	180	470	260	396	164	140	120
4	270	195	167	250	560	250	470	250	387	164	139	120
5	230	180	167	250	530	270	470	240	378	166	138	120
6	230	180	167	250	500	230	457	230	369	222	137	120
7	195	180	167	250	470	210	444	230	360	242	136	120
8	210	210	167	340	440	180	430	210	351	226	134	120
9	210	210	167	365	420	167	417	230	342	230	133	....
10	230	210	172	340	415	154	404	415	333	218	132	....
11	210	210	180	315	365	142	391	415	324	201	131	....
12	210	195	167	315	340	131	378	470	315	190	130	....
13	195	195	180	390	270	167	365	530	306	181	129	....
14	195	180	167	630	250	340	372	630	297	176	128	....
15	180	180	154	630	250	415	379	530	288	171	126	120
16	180	180	167	500	230	390	386	415	279	168	125	120
17	210	180	167	415	230	390	394	390	270	179	125	120
18	250	210	167	390	250	415	401	500	262	164	123	119
19	805	315	167	415	270	365	408	665	254	156	123	119
20	630	290	154	440	250	315	415	665	246	154	120	119
21	470	270	154	470	250	340	403	665	237	152	117	118
22	365	250	154	440	230	415	391	700	228	150	117	118
23	290	250	154	365	210	500	378	665	220	148	119	118
24	270	230	154	290	195	530	365	700	212	146	120	117
25	230	230	154	250	210	500	352	665	204	144	120	117
26	210	210	154	210	195	470	339	700	218	138	120	117
27	195	210	167	210	210	340	326	700	204	133	120	116
28	180	210	180	230	250	365	314	735	193	126	120	115
29	167	195	180	230	....	415	302	630	179	125	120	114
30	180	180	180	250	....	390	290	560	171	136	120	113
31	167	....	180	270	....	365	....	500	....	140	120	....

Note.—Discharge determined from two well-defined rating curves, one applicable Oct. 1 to May 28 and the other May 29 to Sept. 30. Discharge interpolated for days when gage was not working as follows: Apr. 6–12, 14–19, 21–29, May 1–5, June 2–16, 18–24, July 20–24, Aug. 1–13, Sept. 1–2, 4–7, 16–24, and 26–30. Mean discharge Sept. 9–14 estimated as 125 second-feet.

Oreg., for the year ending Sept. 30, 1915.

ischarge in second-feet.			Run-off (total in acre-feet).	Accuracy.
um.	Minimum.	Mean.		
805	129	260	16,000	B.
315	167	210	12,500	B.
180	154	167	10,300	B.
630	210	335	20,600	C.
665	195	347	19,300	C.
530	131	315	19,400	C.
470	....	391	23,300	C.
735	210	485	29,800	B.
415	171	288	17,100	B.
242	125	169	10,400	B.
142	117	127	7,810	B.
......	113	120	7,140	B.
805	113	267	194,000	

ETTE RIVER NEAR OAKRIDGE, OREG.

E., just below highway bridge about 2
above former station.

tember 30, 1915, when station was dis-
r 12, 1909, to September 30, 1912, at

ler just below highway bridge; also in-
t above railroad bridge. Gage reader,

e at old gage, a mile below present site,

n heavy gravel; fairly permanent.
recorded during year, 4.0 feet about
recorder, which was not running (dis-
tage from water-stage recorder, 0.45
ond-feet).
tage recorded, 12.4 feet November 22,
1915.

voir on Waldo Lake not being used.
r periods when recorder was working;
ods.

*ddle Fork of Willamette River near Oak-
nding Sept. 30, 1915.*

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	2.89	1,090
....	1.24	324
....	.51	148

Daily discharge, in second-feet, of North Fork of Middle Fork of Willamette River near Oakridge, Oreg., for the year ending Sept. 30, 1915.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	......	262	352	......	......	744	822	418	770	252	200	147
2	......	265	386	......	......	700	930	406	718	255	196	147
3	......	268	422	......	......	700	1,090	375	644	259	192	145
4	......	271	390	......	1,150	900	1,090	349	583	262	189	144
5	301	274	375	......	1,090	1,000	1,010	334	542	265	187	142
6	285	276	359	......	1,040	850	930	334	506	268	185	140
7	242	279	359	......	984	700	903	331	476	268	183	139
8	261	282	359	......	930	620	822	327	448	269	180	138
9	264	285	363	......	903	592	770	345	430	270	176	138
10	279	288	359	......	822	574	718	442	433	271	172	138
11	282	291	356	......	770	556	718	476	537	271	172	138
12	270	294	349	......	693	565	796	510	560	268	168	142
13	256	......	334	......	644	718	903	560	497	264	164	160
14	......	......	327	......	597	957	849	693	456	261	164	168
15	......	......	327	......	565	1,010	770	693	430	257	164	152
16	......	......	324	......	560	1,010	744	644	412	254	164	148
17	......	......	317	......	620	1,010	744	644	394	251	164	145
18	......	......	310	......	744	1,060	744	957	377	247	164	144
19	......	379	310	......	744	1,010	744	1,150	371	244	162	142
20	......	375	314	......	718	930	718	1,040	355	237	160	142
21	......	363	324	......	668	930	644	1,040	342	230	157	142
22	......	349	......	......	644	1,010	588	1,150	336	223	156	142
23	......	349	......	......	668	1,090	542	1,060	327	216	154	142
24	......	338	......	......	693	1,090	502	1,150	315	209	153	145
25	279	327	......	......	693	984	471	1,060	312	201	152	145
26	270	324	367	......	668	876	455	1,170	283	193	150	144
27	260	320	402	......	693	770	463	1,170	254	186	149	150
28	250	345	450	......	719	770	484	1,170	252	186	148	148
29	253	367	438	......	......	796	467	1,060	251	186	147	142
30	256	359	438	......	......	822	442	930	249	190	146	140
31	259	......	436	......	......	796	......	822	......	200	145	......

NOTE.—Discharge determined from two well-defined rating curves applicable Oct. 1 to May 27 and May 28 to Sept. 30, respectively. Discharge interpolated Oct. 26, 27, Oct. 30 to Nov. 11, June 28, 29, July 1–5, 7–10, 12–15, 17–18, 20–22, 24–26, and Aug. 22–30. Discharge estimated Mar. 1–7 and July 28 to Aug. 9. Mean discharge estimated Oct. 1–4, 300 second-feet; Oct. 14–24, 650 second-feet; Nov. 13–18, 290 second-feet; Dec. 22–25, 300 second-feet; Feb. 1–3, 1,000 second-feet.

Monthly discharge of North Fork of Middle Fork of Willamette River near Oakridge, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	....	242	407	25,000	C.
November	379	....	309	18,400	C.
December	450	....	356	21,900	B.
January	....	....	a 800	49,200	D.
February	....	560	786	43,700	B.
March	1,090	556	843	51,800	B.
April	1,090	442	729	43,400	A.
May	1,170	327	736	45,300	A.
June	770	249	429	25,500	A.
July	271	186	239	14,700	B.
August	200	145	167	10,300	B.
September	168	138	145	8,630	A.
The year	....	....	494	358,000	

a Estimated.

EAR LAKE, OREG.

outlet of Clear Lake in Linn County,
idge, the nearest post office.

y 31, 1915, when station was discon-

staff at the outlet, the latter for check-

ispension footbridge at the outlet.
d volcanic sand and gravel bound
s on each side. Practically permanent.
recorded during year, 9.50 feet April
stage recorded, 7.53 feet September 28

0.69 feet May 27 and June 3, 1913 (dis-
at of 1915.
fected by ice.

by the Oregon Electric Railway Co.

nade by C. L. Batchelder:
(discharge, 165 second-feet).

er at Clear Lake, Oreg., for the year ending
915.

Feb.	Mar.	Apr.	May.	June.	July.
250	274	500	406	448	281
242	274	542	400	436	277
254	274	622	387	428	274
264	281	645	371	420	268
272	279	618	374	411	264
277	274	618	369	400	264
279	272	614	366	392	254
283	270	618	361	384	250
283	270	606	361	379	248
283	268	595	371	374	246
279	266	588	369	369	242
277	266	591	371	364	240
274	268	606	371	356	232
270	272	584	374	351	230
268	279	559	374	347	230
266	288	545	379	344	230
264	294	535	384	339	228
262	305	542	392	335	225
260	314	538	400	332	223
260	326	538	406	328	223
262	335	522	420	323	223
264	344	503	428	319	221
264	353	484	431	314	219
268	369	478	436	310	216
268	377	466	436	305	216
268	387	454	442	303	212
272	392	442	448	299	209
272	404	431	469	292	207
....	428	422	472	288	204
....	448	414	463	288	202
....	460	....	448	....	201

ing curve.

Monthly discharge of McKenzie River at Clear Lake, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	328	256	288	17,700	A.
November	319	292	304	18,100	A.
December	292	209	236	14,500	A.
January	242	209	231	14,200	A.
February	283	242	268	14,900	A.
March	460	266	320	19,700	A.
April	645	414	541	32,200	A.
May	472	361	403	24,800	A.
June	448	288	353	21,000	A.
July	281	201	234	14,400	A.
The period				192,000	

McKENZIE RIVER NEAR McKENZIE BRIDGE, OREG.

Location.—In sec. 17, T. 16 S., R. 6 E., at the Paradise ranger station 2 miles above highway bridge at McKenzie Bridge, Lane County.

Drainage area.—Not measured.

Records available.—August 8, 1910, to September 30, 1915.

Gage.—Vertical staff at Paradise ranger station; read by S. L. Taylor. Gage read in 1914 is staff at Hayes ranch one-half mile above McKenzie Bridge, and a third gage, which was formerly read, is attached to the abutment of the highway bridge at McKenzie Bridge.

Discharge measurements.—Made from cable three-eighths mile above the ranger station.

Channel and control.—Rocky; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 3.00 feet October 19 (discharge, 2,540 second-feet); this is the date on which maxima for the year occurred on adjoining streams. Minimum stage recorded, 1.48 feet September 19, 21, 24, 25 (discharge, 966 second-feet; stage continued to fall until end of month).

1910–1915: Maximum stage recorded, 5.0 feet on gage at highway bridge January 13, 1912 (discharge, 7,400 second-feet); minimum stage recorded is that of 1915.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered good.

Cooperation.—Gage records at ranger station furnished by United States Forest Service, C. R. Seitz, supervisor.

Discharge measurements of McKenzie River near McKenzie Bridge, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 16	R. D. Cooper	2.01	1,420
Sept. 24	Henshaw and Batchelder	1.48	963

Kenzie River near McKenzie Bridge, Oreg.; for the ding Sept. 30, 1915.

Dec.	Apr.	May.	June.	July.	Aug.	Sept.
....	1,750	1,420	1,580	1,240	1,110	1,010
....	1,860	1,400	1,570	1,230	1,100	1,000
....	2,000	1,400	1,560	1,230	1,090	1,000
1,230	1,940	1,390	1,550	1,230	1,090	997
....	1,880	1,380	1,520	1,220	1,090	994
....	1,790	1,380	1,490	1,220	1,080	991
....	1,820	1,370	1,470	1,220	1,080	988
....	1,770	1,360	1,470	1,210	1,080	986
....	1,770	1,380	1,460	1,210	1,070	983
....	1,750	1,420	1,450	1,200	1,070	980
1,170	1,750	1,460	1,440	1,190	1,070	980
....	1,770	1,490	1,430	1,190	1,070	980
1,170	1,790	1,530	1,420	1,190	1,070	980
....	1,740	1,570	1,410	1,180	1,070	978
....	1,690	1,550	1,400	1,180	1,070	976
....	1,690	1,520	1,390	1,170	1,070	973
....	1,690	1,520	1,380	1,160	1,060	970
....	1,690	1,550	1,380	1,160	1,050	968
....	1,670	1,580	1,360	1,150	1,050	966
....	1,670	1,610	1,330	1,150	1,040	966
....	1,620	1,640	1,310	1,150	1,040	966
....	1,600	1,670	1,310	1,150	1,040	966
....	1,580	1,710	1,290	1,150	1,040	966
....	1,560	1,740	1,290	1,140	1,040	966
....	1,530	1,770	1,280	1,140	1,040	965
....	1,510	1,800	1,270	1,140	1,030	964
....	1,490	1,830	1,260	1,140	1,030	963
....	1,470	1,860	1,250	1,130	1,020	962
....	1,460	1,720	1,250	1,130	1,020	961
....	1,450	1,590	1,250	1,130	1,010	960
....	....	1,590	....	1,120	1,010	....

-defined rating curve. Discharge October to December, in-
s read. Discharge interpolated Apr. 22–27, May 10–13, 18–27,
s in July, 11 times in August, and 7 times in September.

near McKenzie Bridge, Oreg., for the year ending Sept. 30, 1915.

Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
Maximum.	Minimum.	Mean.		
2,000	1,450	1,690	101,000	A.
1,860	1,360	1,550	95,300	B.
1,580	1,250	1,390	82,700	A.
1,240	1,120	1,180	72,600	A.
1,110	1,010	1,060	65,200	A.
1,010	960	977	58,100	A.
....	....	....	475,000	

e.

R NEAR SPRINGFIELD, OREG.

1 W., at Hendrick's bridge, 3 miles below Walter-
, and 11 miles above Springfield, Lane County.

.

2, 1905, to March 31, 1915, when station was dis-

read daily. Gage reader, Mrs. N. M. Hendricks.

Discharge measurements.—Made from cable 200 feet below gage.

Channel and control.—Coarse gravel and small boulders; shifting.

Extremes of discharge.—Maximum stage recorded during year, 5.9 feet at noon Ocober 19 (discharge, 11,700 second-feet plus about 300 second-feet in canal, total 12,000 second-feet); minimum stage recorded, 0.40 foot September 25 (discharge, 1,180 second-feet plus 371 second-feet in canal, total 1,550 second-feet).

1905–1915: Maximum stage recorded, 13.0 feet at 5 p. m. November 22, 1909 (discharge, 43,500 second-feet); minimum stage recorded for total flow of river, 1.05 feet November 5, 1910 (discharge, 1,540 second-feet).

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—The power canal of the Eugene municipal plant has diverted water around the station since about February 14, 1911. Record has been kept of this diversion and the amounts added to the discharge of the river station.

Regulation.—None.

Accuracy.—Results considered good.

The following discharge measurement was made by C. G. Paulsen:

December 25, 1914: Gage height, 1.12 feet; discharge, 1,870 second-feet.

Daily discharge, in second-feet, of McKenzie River near Springfield, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	1,700	2,680	2,550	3,080	9,460	3,950
2	2,680	2,680	2,680	3,500	6,630	3,950
3	3,650	2,550	3,080	3,360	7,360	3,800
4	2,680	2,550	2,680	3,220	6,630	3,800
5	2,550	2,430	2,550	3,080	5,940	3,650
6	2,000	2,940	2,550	2,940	5,480	3,650
7	2,000	2,680	2,430	3,080	5,260	3,500
8	2,100	2,430	2,430	6,400	4,440	3,220
9	2,100	2,210	2,550	5,260	4,440	3,360
10	2,320	2,210	2,430	4,270	4,110	3,360
11	1,700	2,210	2,430	3,950	3,950	3,220
12	1,700	2,810	2,430	5,480	3,650	2,940
13	1,700	4,620	2,210	5,260	3,500	3,360
14	2,000	4,270	2,100	10,700	3,220	3,500
15	2,000	4,270	2,100	9,180	3,080	3,950
16	2,100	3,220	2,100	5,480	3,500	4,620
17	2,320	3,080	2,000	4,620	3,650	4,620
18	2,810	2,810	2,100	4,270	4,110	4,440
19	11,700	2,550	2,000	4,440	3,950	4,440
20	6,400	2,550	2,000	4,440	3,650	4,110
21	4,620	2,550	1,900	4,110	3,500	3,950
22	4,270	2,550	1,900	3,800	4,110	4,270
23	3,360	2,430	1,800	3,500	4,110	4,440
24	3,360	2,320	1,800	3,220	3,950	3,950
25	2,810	2,320	1,900	3,080	3,950	4,110
26	2,320	2,320	2,000	2,940	3,800	3,800
27	2,320	2,210	2,550	2,940	3,950	4,440
28	2,320	2,320	2,550	3,220	3,800	4,270
29	2,430	2,320	2,550	3,080	....	3,800
30	2,550	2,550	2,550	2,940	....	4,270
31	2,680	....	2,810	3,500	....	4,440

Note.—Discharge determined from a fairly well defined rating curve.

ver and Eugene power canal near Springfield, Oreg.,
l ending Mar. 31, 1915.

e area, 960 square miles.]

arge in second-feet.				Run-off.		Accuracy.
Mean.	Canal (mean).a	Total (mean).	Per square mile.	Depth in inches.	Total in acre-feet.	
2,940	329	3,270	3.41	3.93	201,000	B.
2,720	341	3,060	3.19	3.56	182,000	B.
2,310	347	2,660	2.77	3.19	164,000	B.
4,270	348	4,620	4.81	5.54	284,000	B.
4,540	335	4,880	5.08	5.29	271,000	B.
3,910	317	4,230	4.41	5.08	260,000	B.
....	....	....	....	....	1,360,000	

l is average of determinations of discharge of canal for days on

ANAL NEAR WALTERVILLE, OREG.

R. 1 W., about 3 miles below the intake, 1¼ miles
ty.
7, 1911, to March 31, 1915, when station was

of wagon bridge; read about three times a week.
Gage used in 1911 and 1912 was at intake.
e from bridge at gage.
practically permanent.
num stage recorded during year, 4.0 feet January
minimum stage recorded, 3.1 feet March 10 (dis-

ecorded, 4.0 feet January 22, 1914, and January 8,
et). Canal probably dry at times.
on which gage was read.
ement was made by C. G. Paulsen:
, 3.36 feet; discharge, 337 second-feet.
s water from McKenzie River in sec. 26, T. 17 S.,
les to the power plant in section 29; the water is
e in section 30.

Eugene power canal near Walterville, Oreg., for the
ending Sept. 30, 1915.

b.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
9	......	16	......	......	......	351	327	......
..	......	17	339	......	......	......	......	327
..	......	18	......	351	339	......	......	......
..	......	19	......	......	......	327	......	......
9	315	20	......	......	......	......	339	......
..	......	21	......	......	......	......	......	......
..	......	22	......	......	......	......	......	327
..	......	23	......	......	......	339	......	......
..	......	24	315	339	351	......	......	......
..	303	25	......	......	......	......	......	......
7	......	26	......	......	......	......	......	......
..	......	27	......	......	......	315	......	315
9	......	28	......	339	339	......	......	......
..	......	29	......	......	......	......	......	......
..	......	30	......	......	......	327	......	......
		31	339	......	......	......	......	......

airly well defined rating curve; given only for days on which

SANTIAM RIVER AT JEFFERSON, OREG.

Location.—In the NE. ¼ sec. 11, T. 10 S., R. 3 W., at the Southern Pacific Railroad bridge in Jefferson, Marion County, about 2½ miles below the junction of the North and South Santiam rivers, and about 9 miles above the mouth.

Drainage area.—1,890 square miles.

Records available.—July 19, 1905, to July 1, 1906; May 15, 1908, to September 30, 1915.

Gage.—Vertical staff on right bank.

Discharge measurements.—Made from Southern Pacific Railroad bridge or from the highway bridge just below it.

Channel and control.—Rock and coarse gravel; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 7.5 feet at 8 a. m. January 15 (discharge, 29,100 second-feet); minimum stage recorded, 0.6 foot September 5 to 11 (discharge, 510 second-feet).

1905–6 and 1908–1915: Maximum stage recorded, 18.2 feet during night of November 22, 1909 (discharge, 108,000 second-feet); minimum stage recorded, 0.4 foot September 16 to 20, 1909, and September 11 to 17, 1910 (discharge, 350 second-feet).

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—The Albany power canal diverts water from South Santiam River near Lebanon, the Salem power canal from North Santiam River near Stayton, and water is diverted from the North Santiam for irrigation near West Stayton.

Regulation.—None.

Accuracy.—Results considered good.

Cooperation.—Gage records furnished by United States Weather Bureau.

The following discharge measurement was made by P. V. Hodges:

September 8, 1915: Gage height, 0.64 foot; discharge, 525 second-feet.

Daily discharge, in second-feet, of Santiam River at Jefferson, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,350	4,330	6,500	7,300	7,700	8,100	7,300	3,790	8,950	1,900	1,040	630
2	1,520	7,300	5,800	11,800	20,100	7,300	8,950	3,530	8,100	1,900	1,040	630
3	9,850	8,100	6,150	9,400	16,300	6,900	10,800	3,530	7,700	1,900	1,040	630
4	6,150	7,700	6,500	8,500	16,800	6,900	12,800	3,530	6,500	1,700	1,040	630
5	4,330	7,300	5,800	7,700	14,300	8,500	9,850	3,270	5,800	1,700	1,040	510
6	3,790	9,850	5,200	7,300	13,800	7,700	8,100	3,020	5,200	1,700	1,040	510
7	3,020	8,100	4,900	7,300	11,800	7,300	8,100	3,020	4,330	2,110	1,040	510
8	2,780	6,900	5,200	10,300	10,300	6,150	7,700	3,020	4,330	2,550	900	510
9	2,780	5,800	5,200	17,300	9,850	5,500	6,900	3,020	4,060	2,780	900	510
10	2,780	5,200	4,330	13,300	9,400	4,900	6,500	3,530	4,060	2,330	900	510
11	3,790	4,330	3,790	12,300	8,100	4,330	5,800	5,800	4,330	2,110	900	510
12	3,790	5,800	3,530	10,800	7,300	4,330	5,800	7,300	4,330	1,900	900	630
13	3,530	9,850	3,270	10,800	6,900	4,610	6,500	7,300	4,330	1,900	900	630
14	3,530	19,500	3,020	26,100	5,800	5,800	7,700	9,850	4,060	1,900	760	760
15	3,020	14,800	2,780	29,100	5,500	8,500	6,150	11,800	3,790	1,700	760	760
16	2,780	11,800	2,330	19,500	4,900	9,850	5,800	8,500	3,530	1,700	760	760
17	2,780	9,400	1,900	14,800	4,330	8,950	5,800	8,500	3,270	1,900	760	760
18	4,060	8,100	1,900	12,300	6,900	9,400	5,500	8,950	3,020	2,110	760	630
19	11,800	6,900	1,700	11,800	7,300	8,100	5,500	14,800	3,020	1,900	760	630
20	22,500	6,150	1,520	11,300	6,900	7,300	5,200	14,300	3,020	1,900	760	630
21	14,800	5,800	1,350	10,300	6,900	7,700	4,330	11,800	2,780	1,700	760	630
22	10,300	5,500	1,350	9,400	7,300	7,300	4,330	11,800	2,780	1,700	630	630
23	7,700	5,200	1,350	8,100	7,300	7,300	3,790	11,800	2,550	1,520	630	630
24	6,500	4,610	1,350	7,300	8,100	7,300	3,790	11,800	2,550	1,520	630	760
25	5,500	4,330	1,350	6,500	9,850	6,900	4,060	11,800	2,550	1,350	630	760
26	4,330	4,330	4,330	5,800	9,400	6,150	4,060	12,300	2,550	1,350	630	760
27	4,060	4,060	7,300	5,200	8,100	5,500	4,060	14,800	2,330	1,350	630	760
28	3,530	3,790	6,900	4,610	8,950	5,200	4,330	17,300	2,330	1,350	630	760
29	3,270	5,800	7,300	4,330	......	4,330	4,330	16,800	2,330	1,350	630	760
30	3,020	7,300	6,900	4,330	......	6,900	4,330	12,300	2,110	1,190	630	760
31	3,530	......	6,900	4,060	......	8,500	......	9,850	......	1,040	630	......

Note.—Discharge determined from a fairly well defined rating curve.

Jefferson, Oreg., for the year ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	22,500	1,350	5,370	330,000	B.
....	19,500	3,790	7,260	432,000	B.
....	7,300	1,350	4,120	253,000	B.
....	29,100	4,060	10,600	652,000	B.
....	20,100	4,330	9,290	516,000	B.
....	9,850	4,330	6,890	424,000	B.
....	12,800	3,790	6,270	373,000	B.
....	17,300	3,020	8,800	541,000	B.
....	8,950	2,110	4,020	239,000	B.
....	2,780	1,040	1,770	109,000	B.
....	1,040	630	808	49,700	B.
....	760	510	650	38,700	B.
....	29,100	510	5,470	3,960,400	

ER NEAR CAZADERO, OREG.

4 S., R. 4 E., a short distance above the back-
the Portland Railway, Light & Power Co., and
ackamas County.

09, to September 30, 1915.

ferred to a vertical staff on right bank. Gage

rom a cable 50 feet below gage.

gravel; shifting in extreme floods.

n stage during year from water-stage recorder,
(discharge, 6,590 second-feet); minimum stage
1 to 23 (discharge, 705 second-feet).

orded, 43.70 feet at 1 p. m. November 22, 1909
inimum is that of 1915.

llent.

River near Cazadero, Oreg., during the year ending
pt. 30, 1915.

Dis- arge.	Date.	Made by—	Gage height.	Discharge.
ec.-ft.			*Feet.*	*Sec.-ft.*
1,560	May 18	Batchelder and Brooks.	27.80	2,960
1,340	July 1	Ewing and Brooks.....	26.25	1,180
3,600	Aug. 16	McMillen and Scupham	25.83	782
3,460	28	.....do..................	25.75	748
2,450	Sept 1	.....do..................	25.74	746
3,140	25	Brooks and Shock......	25.70	706
1,990				

Daily discharge, in second-feet, of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,060	2,080	1,570	2,180	3,520	2,340	3,760	1,820	2,740	1,140	894	727
2	1,560	2,770	1,550	2,460	3,650	2,200	4,530	1,740	2,740	1,100	878	732
3	2,040	2,780	1,610	2,200	3,260	2,100	5,110	1,730	2,550	1,090	878	722
4	1,710	2,550	1,540	2,090	2,930	2,530	4,710	1,720	2,310	1,070	862	722
5	1,530	2,410	1,490	2,000	2,850	2,640	4,000	1,660	2,070	1,050	854	722
6	1,410	2,630	1,410	1,890	2,980	2,420	3,520	1,640	1,900	1,090	838	716
7	1,300	2,330	1,370	1,850	2,730	2,250	3,550	1,620	1,760	1,180	830	716
8	1,250	2,080	1,330	2,900	2,520	2,160	3,400	1,610	1,610	1,160	830	716
9	1,230	1,920	1,310	3,140	2,420	2,040	3,070	1,750	1,600	1,180	830	716
10	1,280	1,780	1,270	2,640	2,300	2,000	2,930	2,310	1,590	1,100	823	716
12	1,350	1,910	1,260	2,380	2,150	1,940	2,890	2,550	2,130	1,070	816	727
13	1,390	2,330	1,210	2,230	2,030	1,870	2,970	2,880	2,310	1,040	809	760
13	1,310	5,230	1,130	2,570	1,930	1,950	3,100	2,940	2,070	991	802	795
14	1,230	4,860	1,110	5,440	1,820	2,640	2,870	2,880	1,850	1,080	781	802
15	1,190	3,500	1,150	4,480	1,790	3,500	2,640	2,740	1,720	1,090	781	760
16	1,150	2,890	1,080	3,050	1,730	3,540	2,570	2,490	1,630	1,070	767	749
17	1,180	2,560	1,000	2,500	1,790	3,320	2,600	2,740	1,560	1,210	760	732
18	1,410	2,350	1,020	2,270	2,210	3,460	2,620	2,810	1,510	1,130	760	727
19	4,990	2,170	1,020	2,220	2,200	3,110	2,580	2,940	1,490	1,070	754	722
20	4,730	2,080	1,020	2,150	2,110	2,870	2,520	2,810	1,480	1,030	760	716
21	3,330	2,000	1,030	2,050	2,070	2,850	2,350	2,680	1,410	991	760	705
22	2,600	1,890	1,040	1,920	2,120	2,880	2,220	2,550	1,330	964	754	705
23	2,160	1,910	1,030	1,810	2,190	3,350	2,170	2,490	1,330	937	749	705
24	1,890	1,820	1,030	1,700	2,510	3,450	2,140	2,490	1,280	937	738	710
25	1,730	1,730	1,020	1,610	2,730	3,080	2,130	2,490	1,280	919	738	705
26	1,600	1,680	1,320	1,580	2,520	2,720	2,030	2,620	1,360	910	738	705
27	1,500	1,640	1,330	1,510	2,410	2,510	1,940	2,620	1,310	902	732	727
28	1,380	1,700	1,570	1,460	2,430	2,500	1,920	3,070	1,230	902	732	727
29	1,340	1,720	1,500	1,430	....	3,000	1,890	2,940	1,190	902	732	716
30	1,310	1,620	1,620	1,450	....	3,320	1,840	2,620	1,170	902	727	705
31	1,510	....	1,730	1,510	....	3,490	....	2,310	....	894	727	....

NOTE.—Discharge determined from a well-defined rating curve.

Monthly discharge of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 685 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	4,990	1,060	1,760	2.57	2.96	108,000	A.
November	5,230	1,620	2,360	3.45	3.85	140,000	A.
December	1,730	1,000	1,280	1.87	2.16	78,700	A.
January	5,440	1,430	2,280	3.33	3.84	140,000	A.
February	3,650	1,730	2,420	3.53	3.68	134,000	A.
March	3,540	1,870	2,710	3.96	4.56	167,000	A.
April	5,110	1,840	2,890	4.22	4.71	172,000	A.
May	3,070	1,610	2,400	3.50	4.04	148,000	A.
June	2,740	1,170	1,720	2.51	2.80	102,000	A.
July	1,210	894	1,040	1.52	1.75	64,000	A.
August	894	727	788	1.15	1.33	48,500	A.
September	802	705	727	1.06	1.18	43,300	A.
The year	5,440	705	1,860	2.72	36.86	1,350,000	

AMAS RIVER AT TIMOTHY MEADOWS, NEAR AZADERO, OREG.

bout sec. 26 (unsurveyed), at Timothy Meadows, at intake, about 17 miles above mouth of Oak ve Cazadero, Clackamas County.

, 1913, to September 30, 1915.
stage recorder on right bank.
e from footbridge 20 feet above gage.
, gravel; control practically permanent, but may

um stage during year from water-stage recorder, ischarge, 245 second-feet). Minimum stage from September 10 and 11 (discharge, 118 second-feet). ecorded, 2.15 feet May 27, 1913 (discharge, 496 is that of 1915.
cellent.
d by Portland Railway, Light & Power Co.

ment was made by N. W. McMillen:
68 foot; discharge, 138 second-feet.

Grove Fork of Clackamas River at Timothy Meadows or the year ending Sept. 30, 1915.

.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.
1	....	127	210	194	129	131	....
1	....	127	218	192	129	129	....
8	....	127	237	186	129	129	121
6	....	131	235	179	129	127	122
6	....	129	226	173	129	129	122
9	....	129	220	170	131	129	122
6	....	127	230	166	131	127	121
6	....	127	224	164	134	126	121
6	....	127	216	170	134	126	120
4	....	127	214	179	132	124	120
4	....	127	216	192	132	124	118
4	....	132	220	202	132	....	....
5	....	143	224	206	132	....	....
8	....	154	220	200	134	....	....
5	....	164	212	188	132	....	....
1	....	170	214	....	132	....	....
9	....	168	214	....	134	....	....
8	....	168	218	....	134	....	....
8	....	168	218	....	134	....	....
6	....	169	220	....	134	....	....
6	....	173	218	....	132	....	....
..	....	173	212	....	131	....	....
..	124	177	214	....	129	138	....
..	127	177	214	....	127	....	....
..	127	172	220	....	127	....	....
..	127	166	212	....	129	....	....
..	127	163	210	....	129	....	....
..	127	172	202	....	129	....	....
..	....	192	202	....	131	....	....
..	....	200	198	....	131	....	....
..	....	198	....	....	131	....	....

n well-defined rating curve. Mean discharge estimated as -31, 174 second-feet; Aug. 12–22, 131 second-feet; Aug. 24-31, ; Sept. 12–30, 117 second-feet.

Monthly discharge of Oak Grove Fork of Clackamas River at Timothy Meadows near Cazadero, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	148	131	134	8,240	A.
November	155		138	8.210	A.
December			[a] 128	7,870	C.
January			[a] 119	7,320	C.
February			[a] 122	6,780	B.
March	200	127	155	9,530	A.
April	237	198	217	12,900	A.
May	206		179	11,000	B.
June			[a] 169	10,100	C.
July	134	127	131	8,060	A.
August			130	7,990	B.
September			118	7,020	B.
The year	237		145	105,000	

[a] Estimated from station at intake.

OAK GROVE FORK OF CLACKAMAS RIVER AT INTAKE NEAR CAZADERO, OREG.

Location.—In the SW. ¼ sec. 4, T. 6 S., R. 7 E., 2,000 feet above proposed intake of Oak Grove power development of Portland Railway, Light & Power Co., and about 35 miles above Cazadero, Clackamas County.

Drainage area.—131 square miles (measured by Portland Railway, Light & Power Co.

Records available.—May 21, 1909, to September 30, 1915.

Gage.—Friez water-stage recorder installed on left bank since October, 1913; Watson recording gage used March, 1912, to September, 1913; vertical staff prior to March, 1912.

Discharge measurements.—Made from cable; velocities high; channel straight.

Channel and control.—Gravel; fairly permanent.

Extremes of discharge.—Maximum stage during year from water-stage recorder, 1.60 feet at 9 p. m., April 3 (discharge, 860 second-feet). Minimum stage from water-stage recorder, 0. 62 foot September 20 to 30 (discharge, 347 second-feet).

1909–1915: Maximum stage recorded, 3.40 feet November 24, 1909 (discharge, 2,670 second-feet). Minimum discharge, 320 second-feet (gage height, 0. 60 foot) October 17 to November 3, 1911.

Ice.—Never any ice, as stream is largely spring-fed.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered good.

Cooperation.—Field data furinshed by Portland Railway, Light & Power Co.

The following discharge measurement was made by N. W. McMillen:

August 24, 1915: Gage height, 0. 65 foot; discharge, 363 second-feet.

ak Grove Fork of Clackamas River at intake near or the year ending Sept. 30, 1915.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
413	405	692	565	491	395	383	354
405	397	734	555	500	395	383	354
397	393	839	545	496	395	383	354
389	425	811	530	482	391	383	354
389	413	769	530	482	391	383	350
385	409	734	530	478	395	383	350
385	405	769	530	473	395	383	350
385	405	741	525	468	399	383	350
385	405	714	525	455	395	383	350
382	401	702	525	455	391	383	350
378	405	702	525	460	391	379	350
368	409	720	525	464	387	375	350
368	438	708	525	460	391	361	350
368	480	666	520	451	391	358	350
368	535	660	520	443	383	358	350
368	545	648	540	435	387	358	350
368	545	648	530	431	387	358	350
368	550	648	520	431	387	358	350
368	530	648	510	431	387	358	350
368	530	648	515	427	387	358	347
368	545	630	525	423	387	358	347
368	550	612	525	419	387	358	347
371	570	618	520	419	387	358	347
389	590	618	505	411	387	358	347
397	580	606	515	407	383	358	347
385	555	585	515	415	383	358	347
393	545	575	510	407	383	358	347
401	570	575	510	399	383	358	347
....	620	580	491	399	383	358	347
....	632	570	482	395	383	354	347
....	632	....	478	....	383	354	....

n two fairly well defined rating curves applicable Oct. 1 to Apr. aily discharge interpolated Oct. 6-8, May 5-11, 17, 18, July 5, 6,

k of Clackamas River at intake near Cazadero, Oreg., ar ending Sept. 30, 1915.

	Discharge in second feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	393	350	365	22,400	A.
....	500	371	394	23,400	A.
....	389	350	365	22,400	A.
....	405	350	361	22,200	A.
....	413	368	381	21,200	A.
....	632	393	497	30,600	A.
....	839	570	672	40,000	B.
....	565	478	521	32,000	B.
....	500	395	414	26,400	A.
....	399	383	389	23,900	A.
....	383	354	367	22,600	A.
....	354	347	349	20,800	A.
....	839	347	425	308,000	

LEWIS RIVER BASIN.

LEWIS RIVER NEAR AMBOY, WASH.

Location.—In sec. 36, T. 6 N., R. 3 E., at Cresap's ferry crossing, on the county road from Amboy to Cougar, 1½ miles below Canyon Creek, 2 miles above Speilei Creek, and about 5 miles northeast of Amboy, Clarke County.

Drainage area.—665 square miles (measured on map in Water-Supply Paper 253, p. 74, and checked on Forest Service map).

Records available.—January 20, 1911, to September 30, 1915.

Gage.—Inclined staff on left bank, replacing vertical staff at same location and datum; read once daily. Gage reader, Philip Hanley.

Discharge measurements.—Made from the ferry or from a boat about 30 feet above the gage.

Channel and control.—Gravel and small boulders; practically permanent.

Extremes of discharge.—Maximum stage recorded during year, 6.7 feet at 8 a. m. April 2 (discharge, 15,800 second-feet); minimum stage recorded, 0.08 foot September 30 (discharge, 686 second-feet).

1911–1915: Maximum stage recorded, 11.4 feet at 4 p. m. January 5, 1914 (discharge, 35,000 second-feet); minimum stage recorded is that of 1915.

Winter flow.—Stage-discharge relation never affected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered excellent except for extremely high and low stages.

The following discharge measurement was made by C. L. Batchelder:

August 10, 1915: Gage height, 0.48 foot; discharge, 981 second-feet.

Daily discharge, in second-feet, of Lewis River near Amboy, Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,560	3,450	3,630	5,360	4,200	3,630	9,530	2,470	3,810	1,400	1,070	840
2	2,940	6,100	3,450	4,880	3,810	3,450	15,200	2,320	3,450	1,300	1,070	840
3	2,780	12,700	3,280	4,650	3,810	3,280	13,800	2,180	3,110	1,300	1,070	840
4	2,470	10,200	3,110	4,000	3,630	3,450	11,400	2,320	2,940	1,300	990	840
5	2,180	8,300	2,940	3,630	6,360	3,280	8,600	2,180	2,780	1,300	990	840
6	2,040	7,430	2,940	3,280	5,850	3,110	7,160	2,320	2,620	1,300	990	805
7	1,910	6,100	2,780	3,450	5,360	2,940	6,890	2,320	2,470	1,400	950	770
8	1,790	5,360	2,780	4,420	4,420	2,940	6,100	2,320	2,320	1,450	950	770
9	1,790	5,120	2,620	4,200	4,000	2,940	5,600	2,620	2,180	1,450	950	770
10	2,470	4,420	2,470	4,000	3,630	2,780	4,880	3,110	2,040	1,350	950	770
11	2,470	5,360	2,320	4,880	3,450	2,780	4,650	3,110	2,040	1,250	950	770
12	2,180	6,100	2,180	5,360	3,280	2,780	4,650	2,940	1,910	1,250	910	840
13	1,790	12,700	2,180	5,600	3,280	3,110	4,880	2,780	1,910	1,200	910	840
14	1,790	10,800	2,040	6,890	2,940	5,360	4,420	2,620	1,790	1,200	910	805
15	2,320	7,710	2,040	5,850	2,940	7,430	4,200	2,470	1,790	1,350	910	770
16	2,470	7,160	1,910	4,880	2,620	7,160	4,200	2,320	1,790	1,450	910	770
17	2,940	6,360	1,910	4,200	3,630	6,360	4,200	2,320	1,670	1,560	910	770
18	4,650	5,360	1,790	4,000	3,450	6,360	4,200	2,320	1,670	1,450	910	770
19	12,700	4,650	1,790	3,810	3,110	5,850	4,000	2,620	1,560	1,400	910	735
20	8,910	4,200	1,670	3,450	3,110	5,120	4,200	2,470	1,560	1,350	910	735
21	7,160	4,200	1,670	3,110	3,110	5,120	3,810	2,620	1,560	1,250	910	735
22	6,100	4,000	1,670	3,110	3,450	5,360	3,630	2,780	1,560	1,200	910	735
23	4,880	4,000	1,670	2,940	3,450	5,600	3,280	2,780	1,450	1,160	875	735
24	4,200	3,810	1,670	2,780	3,630	5,360	3,110	2,940	1,450	1,160	840	700
25	3,810	3,630	1,670	2,620	4,650	4,880	2,940	3,280	1,450	1,160	840	700
26	3,450	3,630	3,110	2,470	4,200	4,650	2,780	4,200	1,560	1,120	840	700
27	3,110	3,450	4,000	2,320	4,000	4,000	2,780	4,880	1,560	1,120	840	735
28	2,940	3,630	3,450	2,320	3,810	3,810	2,780	6,890	1,450	1,120	840	735
29	2,780	3,810	3,280	2,040	....	4,200	2,780	5,360	1,450	1,120	840	700
30	2,620	3,810	3,280	2,470	....	4,420	2,620	4,650	1,450	1,120	805	686
31	3,110	....	4,200	2,470	....	4,650	....	4,000	....	1,120	805	....

Note.—Discharge determined from a rating curve well defined between 900 and 14,000 second-feet.

near Amboy, Wash., for the year ending Sept. 30, 1915.

inage area, 665 square miles.]

ischarge in second-feet.			Run-off.		Accuracy.
Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1,560	3,490	5.25	6.05	215,000	A.
3,450	5,920	8.90	9.93	352,000	A.
1,670	2,560	3.85	4.44	157,000	A.
2,040	3,850	5.79	6.68	237,000	A.
2,620	3,830	5.76	6.00	213,000	A.
2,780	4,390	6.60	7.61	270,000	A.
2,620	5,440	8.18	9.13	324,000	A.
2,180	3,050	4.59	5.29	188,000	A.
1,450	2,010	3.02	3.37	120,000	A.
1,120	1,280	1.93	2.22	78,700	A.
805	918	1.38	1.59	56,400	A.
686	769	1,16	1,29	45,800	B.
686	3,120	4.69	63.60	2,260,000	

WLITZ RIVER BASIN.

OSH RIVER NEAR LEWIS, WASH.

N., R. 10 E. Willamette meridian, above Clear Fork, ewis, in Lewis County.

miles (measured on Pl. I, Water-Supply Paper 313).

19, 1907, to January 12, 1913; April 14, 1913, to Sep-

May 1, 1915, vertical staff on left bank, about 900 feet k; since May 4, 1915, inclined staff 8 feet downstream l; read to hundredths twice a week by J. L. Jennings. vertical staff 8 feet upstream from present gage and at .06 foot lower.

-Made from cable 30 feet below gage or by wading.

l composed of gravel and small boulders which shift at l at all stages; banks not subject to overflow. Stage of gust 28, 1915, gage height −1.00± .3 foot.

Maximum stage recorded during the year, 4.9 feet at arge, 2,700 second-feet); minimum stage recorded 0.20 er 28 (discharge, 56 second-feet).

stage recorded, above top of gage (8.0 feet) November ated at 7,500 second-feet); minimum stage recorded, 0.20

arge relation not seriously affected by ice; open-channel plicable.

or days when gage was read.

t record furnished by Portland Railway, Light & Power

Discharge measurements of Ohanapecosh River near Lewis, Wash., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	I. L. Collier	0.78	166	June 3	C. G. Paulsen	1.64	521
Apr. 16	C. G. Paulsen	2.00	680	Aug. 28	.....do	.49	113
18	Parker and Paulsen	2.44	893				

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1			375					460				
2				164	143	170				322		
3	162	2,700					2,140		522		204	
4								460				92
5			278	195								
6					225	181	990			270		
7	167	930										73
8			225					680	500			
9				195	195	173						
10	225	600					568			204	137	
11								635				71
12			167	195					420			
13	550				210	167	770			204		
14		1,450									129	63
15			167					440	380			
16				183	167	575	680			235		
17	438	600									146	
18							930	635				77
19			162	173					360			
20	870				167	460				204		
21		930									164	77
22			140					480	340			
23				167	162	755				204		
24	395	650					500				158	
25								500				70
26			125	140			522		270			
27	355				173	415				179		
28		505									113	56
29			115					990	270			
30				140		460						
31	505							635		204	115	

NOTE.—Discharge determined as follows: Oct. 1 to Apr. 1, from a rating curve well defined above and fairly well defined below 100 second-feet; Apr. 2 to Sept. 30, from a rating curve well defined above and fairly well defined below 70 second-feet.

COWLITZ RIVER AT LEWIS, WASH.

LOCATION.—In sec. 15, T. 13, N., R. 9 E. Willamette meridian, at suspension bridge, about 1 mile northeast of Lewis and 1½ miles below Lake Creek, in Lewis County.

DRAINAGE AREA.—275 miles (measured on Pl. I, Water-Supply Paper 313).

RECORDS AVAILABLE.—July 1, 1911, to September 30, 1915.

GAGE.—October 1, 1914, to May 3, 1915, vertical staff on left bank 110 feet below suspension bridge; May 4 to September 30, 1915, vertical staff bolted to solid rock on left bank 40 feet above suspension bridge. Gage read to hundredths once daily from June to September by J. L Jennings and William Sethe. The gage used prior to May 4, 1915, was one of several that had been maintained at the same site and at approximately the same datum, since August 15, 1907, when the original gage was installed by the Valley Development Co. The gage in use July 1, 1911, was washed out November 20, 1911, reinstalled November 27, 1911, again washed out November 3, 1914, and replaced November 9, 1914. Datum of gage installed May 4, 1915, entirely different from that of gages previously used.

DISCHARGE MEASUREMENTS.—Made from bridge at the gage or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and sand; likely to shift. Right bank subject to overflow at extremely high stages. Control is a gravel and boulder riffle 300 feet below the gage. Stage of zero flow determined from new gage August 29, 1915, −1.8 feet ±0.3 foot.

imum stage recorded during year, 7.1 feet at 9.30
, 13,400 second-feet); minimum stage recorded, 0.43
(discharge, 375 second-feet).
e recorded, 7.35 feet November 19, 1911 (discharge
out on following day); minimum stage recorded, 0.95
3, 1911 (discharge, 285 second-feet).
relation not affected by ice.

siderable diurnal fluctuation March to June.
ord furnished by United States Forest Service and
Power Co.

tz River at Lewis, Wash., during the year ending Sept. 30, 1915.

.				Gage height.		
ew ge.	Dis-charge.	Date.	Made by—	Old gage.	New gage.	Dis-charge.
eet.	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
....	[a] 615	June 4	C. G. Paulsen......	1.80	1.90	[b] 1,260
.46	[a] 1,940	Aug. 26	.....do...............	......	1.44	885
.64	[a] 2,170	29	.....do...............	......	1.14	666
.14	[b] 1,530					

above gage.   [b] Measured from cable 100 feet below gage.

of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1915.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
	628	590	555	1,780	1,140	1,540	1,000	799	600
	666	555	555	7,190	1,110	1,400	1,080	823	600
	666	555	520	5,150	1,080	1,270	1,080	846	483
	666	520	555	3,840	1,080	1,270	1,080	627	483
	628	590	590	2,530	1,000	1,300	1,000	686	483
0	628	707	590	2,370	1,170	1,320	920	744	483
5	590	707	572	2,220	1,370	1,340	960	846	424
7	628	666	555	1,920	1,370	1,370	1,080	846	443
0	666	707	555	1,710	1,520	1,340	928	750	462
0	666	628	555	1,640	1,660	1,320	776	654	434
5	666	590	555	1,680	1,480	1,300	712	640	407
5	666	590	555	1,710	1,220	1,270	683	627	443
0	666	555	520	1,920	1,040	1,140	712	600	390
0	707	522	1,220	1,580	1,040	1,000	654	654	390
0	666	488	1,920	1,510	920	1,040	695	683	390
20	628	520	1,640	1,710	1,000	1,000	735	712	421
88	628	555	1,380	1,920	1,080	962	776	627	452
20	590	590	1,380	2,220	1,480	922	683	654	483
88	590	555	1,260	2,220	1,220	883	730	744	476
72	590	520	1,200	2,220	1,170	895	776	811	469
55	555	520	1,230	1,710	1,040	908	760	744	462
55	555	520	1,260	1,380	1,040	920	744	744	457
55	555	520	1,780	1,260	1,040	1,120	744	744	452
25	538	520	1,710	1,140	1,040	966	724	776	448
55	520	590	1,440	1,200	1,170	811	703	654	443
88	520	555	1,200	1,260	1,170	776	683	776	424
72	488	555	1,080	1,260	1,270	776	712	776	375
55	488	555	1,170	1,380	1,370	811	712	600	375
55	488	....	1,260	1,580	1,420	846	712	683	424
88	455	....	1,320	1,260	1,510	920	744	883	462
555	522	....	1,380	....	1,600	....	776	600	....

s follows: Oct. 1 to Nov. 3, from a rating curve well defined between 550
y 3, from a rating curve very well defined between 900 and 2,400 second-
-defined rating curve. Discharge interpolated for lack of gage readings,
21, 23, Nov. 4-8, Dec. 20, 27, Jan. 10, 24, 31, Feb. 14, 21, 28, Mar. 7, 14, 21,
30, June 2, 5-7, 9-11, 13, 16-18, 20-21, 24, July 1, 9, 15-16, 19, 21, 24-25, 28,
, 4, 8, 10, 16-17, 19-20, 22-24.

Monthly discharge of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1915.

[Drainage area, 275 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	1,760	588	983	3.57	4.12	60,400	B.
November	13,400	1,260	3,630	13.2	14.73	216,000	B.
December	1,140	425	584	2.12	2.44	35,900	B.
January	707	455	597	2.17	2.50	36,700	B.
February	707	488	573	2.08	2.17	31,800	B.
March	1,920	520	1,030	3.75	4.32	63,300	A.
April	7,190	1,140	2,080	7.56	8.44	124,000	A.
May	1,660	920	1,220	4.44	5.12	75,000	A.
June	1,540	776	1,090	3.96	4.42	64,900	B.
July	1,080	654	809	2.94	3.39	49,700	B.
August	883	600	721	2.62	3.02	44,300	B.
September	600	375	451	1.64	1.83	26,800	B.
The year	13,400	375	1,150	4.18	56.50	829,000	

COWLITZ RIVER AT MOSSY ROCK, WASH.

Location.—In sec. 1, T. 12 N., R. 2 E., at county highway bridge 1 mile north of Mossy Rock, in Lewis County, and 2½ miles above mouth of Tilton River.

Drainage area.—1,170 square miles (measured on Pl. I, Water-Supply Paper 313).

Records available.—January 1, 1912, to September 30, 1915 (fragmentary).

Gage.—Vertical staff in 3 sections on left bank, 100 feet above bridge; read once a day to tenths by G. W. Jerrells. Prior to September 18, 1913, a chain gage on the bridge, at a different datum.

Discharge measurements.—Made from highway bridge.

Channel and control.—Channel above and below gage is a deep canyon with almost vertical walls. Control is a broad riffle 450 feet below gage; composed of sand, gravel, and boulders; shifting at high stages. Stage of zero flow, about gage height, −0.9 foot.

Extremes of discharge.—Maximum stage recorded during year, 12.0 feet at 8 a. m. April 3 (discharge, 17,900 second-feet); minimum stage recorded, 1.45 feet September 30 (discharge, 862 second-feet).

1912–1915: Maximum stage recorded, 18.0 feet January 7 to 8, 1914 (discharge, 30,300 second-feet); minimum stage recorded September 30, 1915.

Winter flow.—Stage-discharge relation not affected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Stage-discharge relation was changed during high water of April 3, 1915. Gage-height record prior to April, 1915, not very reliable. Practically no diurnal fluctuations. Results October to March, fair; April to September, excellent.

Discharge measurements of Cowlitz River at Mossy Rock, Wash., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 21	C. G. Paulsen	3.78	3,440	Sept. 1	C. G. Paulsen	2.02	1,350
21	....do	3.78	3,460	30	A. H. Tuttle	1.46	862
June 1	G. L. Parker	4.45	4,660	30	....do	1.46	841
July 8	C. G. Paulsen	2.78	2,190				

itz River at Mossy Rock, Wash., for the year ending
ept. 30, 1915.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	1,520	1,970	3,790	3,140	4,430	2,330	1,730	1,300
	1,630	1,970	10,500	3,140	4,260	2,460	1,730	1,300
	1,740	1,970	17,900	3,000	3,920	2,460	1,730	1,220
	1,860	1,970	13,400	3,290	3,760	2,460	1,730	1,130
	1,970.	1,860	8,560	3,600	3,600	2,460	1,730	1,130
	1,970	1,740	7,110	3,760	3,600	2,330	1,730	1,130
	2,090	1,740	7,470	3,920	3,760	2,330	1,730	1,050
0	2,090	1,740	7,110	3,920	3,760	2,210	1,730	1,050
0	2,210	1,740	6,390	3,920	3,290	2,210	1,610	1,050
0	2,210	1,740	6,030	3,920	3,600	2,090	1,610	975
0	2,090	1,860	5,670	3,902	2,860	1,970	1,610	975
0	1,970	1,970	5,670	3,920	2,720	1,970	1,610	975
0	1,970	1,970	5,670	3,920	2,590	1,970	1,500	1,050
0	1,970	2,210	5,670	3,920	2,590	1,850	1,500	975
0	1,970	2,730	5,670	3,920	2,590	1,850	1,500	975
0	1,970	3,160	5,670	3,920	2,720	1,730	1,500	900
0	1,970	3,790	5,670	3,920	2,590	1,850	1,500	900
0	1,860	3,310	5,490	3,600	2,460	1,850	1,500	900
0	1,740	3,010	5,130	3,440	2,330	1,850	1,500	975
0	1,740	2,460	4,780	3,600	2,590	1,850	1,400	975
70	1,740	2,210	4,260	3,600	2,460	1,850	1,400	975
70	1,740	2,330	4,090	3,440	2,210	1,850	1,400	975
60	1,740	2,460	3,920	3,290	2,210	1,850	1,400	975
60	1,860	2,730	3,920	3,000	2,330	1,850	1,400	975
40	1,970	3,010	3,920	3,000	2,460	1,850	1,400	900
40	1,970	3,310	3,760	3,290	2,330	1,730	1,400	900
30	1,970	3,310	3,600	3,290	2,210	1,850	1,400	975
30	1,970	3,310	3,440	5,670	2,210	1,610	1,400	975
20	....	3,310	3,290	6,750	2,210	1,610	1,400	975
20	....	3,470	3,290	5,670	2,210	1,730	1,400	862
20	....	3,470	....	4,780	....	1,730	1,400	....

Oct. 1 to Apr. 2, from rating curve fairly well defined up to 7,000
defined curve.

t Mossy Rock, Wash., for the year ending Sept. 30,1915.

age area, 1,170 square miles.]

	ischarge in second-feet.			Run-off.		Accuracy.
	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
	1,140	2,970	2.51	2.89	181,000	B.
	3,630	8,440	7.21	8.04	502,000	C.
	1,320	1,790	1.53	1.76	110,000	C.
	1,220	1,780	1.52	1.75	109,000	C.
	1,520	1,910	1.63	1.70	106,000	C.
	1,740	2,510	2.15	2.48	154,000	C.
0	3,290	6,030	5.15	5.75	359,000	B.
0	3,000	3,850	3.29	3.79	237,000	A.
0	2,210	2,900	2.48	2.77	173,000	A.
0	1,610	1,990	1.70	1.96	122,000	A.
0	1,400	1,530	1.31	1.51	94,100	A.
0	862	1,010	.864	.96	60,100	A.
0	862	3,050	2.61	35.36	2,210,000	

R FORK NEAR LEWIS, WASH.

., R. 10 E., above Yakima trail bridge, 1 000 feet above
ortheast of Lewis, in Lewis County.

niles (measured on Pl. I, Water-Supply Paper 313).

t 20, 1907, to September 20, 1915.

bank, 350 feet above Yakima trail bridge. Gage washed
1912, but replaced at same site and approximately same
nt datum to that maintained prior to 1912 somewhat un-
ndredths twice a week by J. L. Jennings.

Discharge measurements.—Made from cable at gage or by wading.

Channel and control.—Bed composed of gravel and boulders, shifting during floods. One channel at all stages. Stage of zero flow determined September 9, 1913, as at gage height −1.0 foot, ±0.1 foot.

Extremes of discharge.—Maximum stage recorded during year, 4.3 feet at 11.50 a. m., November 3 (discharge, 1,320 second-feet); minimum stage recorded, 1.16 feet at 11.15 a. m., September 28 (discharge, 43 second-feet).

1907–1915: Maximum stage recorded, 7.3 feet November 23, 1909 (discharge, 2,530 second-feet); minimum stage recorded September 28, 1915.

Winter flow.—Stage-discharge relation probably not affected by ice; open-channel rating assumed applicable.

Diversions.—None.

Regulation.—None.

Accuracy.—Results excellent. Considerable diurnal fluctuation March to June.

Cooperation.—Gage height record furnished by Portland Railway, Light & Power Co.

Discharge measurements of Clear Fork near Lewis, Wash., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.		Discharge.	Date.	Made by—	Gage height.		Discharge.
		Old gage.	New gage.				Old gage.	New gage.	
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
Oct. 3	I. L. Collier	0.95		a 109	June 3	C. G. Paulsen	1.53	2.21	196
Apr. 16	G. L. Parker	1.86	2.51	a 256	Aug. 28	do		1.26	51
18	Paulsen and Parker	2.11	2.76	321					

a Measured by wading 500 feet below gage.

Daily discharge, in second-feet, of Clear Fork near Lewis, Wash., for the years ending Sept. 30, 1914–15.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	100			100	131					312		
2		174	230			285						78
3	100			100	124		162		536			
4		164	206			206		422				
5	88			1,680							110	
6		254	184		117	179	298					
7	146			1,150								
8		242	164		104	188				216		78
9	130			536			298	422				79
10		280	146		104	179			226			
11	294			326								
12		230	146		110	188					104	
13	368			248			458	576				
14		184	155		110	312			356			
15	308			206						197		
16		184	146		104	388	536					117
17	254			188								
18		280	138		104	356						
19	230			162							98	
20		242	130		104	356	536	458				
21	294			162						138		
22		230	122		131	326						124
23	230			237								
24		368	114		138	260	326		260			
25	267			188								
26		323	114		131	197					84	
27	230			162			260	356				
28		308	107		206	179						
29	174			146						117		98
30		280	100			170	237					
31	164			146								

near Lewis, Wash., during the year ending Sept. *15*—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
			162				
92	92				230		
		750		188		74	
			179				50
104	92	405			115		
							46
			248	208			
104	92						
		260			87	63	
			216				45
				178			
98	86	326			87		
						63	51
			154	168			
92	170	260					
					87	63	
		326	216				50
				100			
86	188				87		
						56	46
			170	132			
86	272				82		
		179				54	
			178				46
		197		115			
92	170				75		
						51	43
			304	124			
	206						
			230		80	52	

-defined rating curves applicable Oct. 1, 1913, to Jan. 4, 1914; o Sept. 30, 1915; determinations given only for days on which ept. 30, 1914, revised since publication in Water-Supply Paper

T MOUTH, NEAR LEWIS, WASH.

. 10 E., at Yakima trail bridge, half a mile above northeast of Lewis, in Lewis County.

y 10 square miles (measured on Pl. I, Water-Supply

er 6, 1910, to January 20, 1913, and April 13, 1913, station was discontinued.

t, nailed to large stump on left bank, 10 feet above ad to hundredths two and three times a week by

ade by wading near gage and from Yakima trail

channel at all stages; bed composed of large boulders d; not subject to shifting. Stage of zero flow gage etermined October 3, 1914, and August 28, 1915.

ximum stage recorded during year, 3.0 feet November eet); minimum stage recorded, 0.55 foot September second-feet).

age recorded, 3.6 feet November 19, 1911 (discharge, stage recorded, 0.5 foot September 8, 1911 (discharge,

Winter flow.—Stage-discharge relation probably not affected by ice; open-channel rating curve assumed applicable.

Diversions.—None.

Regulation.—None.

Accuracy.—Record of daily discharge excellent; but accuracy of monthly means impaired by incompleteness of gage-height record.

Cooperation.—Gage-height record furnished by Valley Development Co.

Discharge measurements of Coal Creek at mouth, near Lewis, Wash., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 3	I. L. Collier	0.82	12.4	June 4	C. G. Paulsen	1.22	26.7
Apr. 17	C. G. Paulsen	1.53	49.6	Aug. 28	.....do	.59	4.0

Daily discharge, in second-feet, of Coal Creek at mouth, near Lewis, Wash., for the years ending Sept. 30, 1911-1915.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1910-11.											
1	......	40	26	19	8.5	70	50	214	50	10	3.8
2	......	97	24	17	8.5	70	70	189	50	10	4.5
3	......	97	24	17	8.5	56	78	189	56	10	4.5
4	......	97	26	17	12	45	88	97	70	10	4.5
5	......	78	26	15	12	40	97	70	56	10	7.0
6	24	62	36	15	12	32	78	70	56	8.5	5.8
7	141	78	50	13	13	29	62	78	50	8.5	5.8
8	141	62	45	13	13	29	62	78	40	8.5	3.0
9	78	50	40	13	13	29	56	78	32	7.0	......
10	......	40	32	13	13	29	45	97	32	7.0	15
11	266	40	32	13	13	26	40	202	29	7.0	......
12	165	36	29	12	12	24	45	214	29	7.0	8.5
13	97	29	24	12	12	21	45	189	29	7.0	......
14	78	29	19	12	12	21	40	165	29	7.0	10
15	50	26	19	12	17	21	45	130	29	7.0	......
16	40	29	19	10	24	24	78	118	26	7.0	40
17	32	26	21	10	10	21	78	97	24	7.0	......
18	32	26	21	10	40	26	97	78	21	5.8	36
19	29	29	24	10	40	26	88	70	19	5.8	......
20	97	26	21	10	56	26	70	56	19	7.0	24
21	......	26	19	10	70	32	78	62	17	7.0	......
22	240	24	17	10	78	40	97	70	17	5.8	19
23	189	40	17	10	108	40	78	50	15	5.8	......
24	141	56	17	10	88	70	70	40	15	4.5	13
25	97	50	15	10	62	118	56	36	13	4.5	......
26	62	40	15	10	56	88	50	45	13	4.5	13
27	50	40	13	8.5	70	62	50	70	13	4.5	......
28	40	32	13	8.5	32	50	56	62	12	4.5	12
29	40	29	13	......	32	......	70	50	12	3.8	......
30	40	32	17	......	36	......	118	50	12	4.5	10
31	......	29	19	......	50	......	189	......	10	4.5	......

Creek at mouth, near Lewis, Wash., for the years
, 1911–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
97		29	32			10	
	17			165	48		40
50		40	31			13	
	17			130	40		31
58		32	32			9.4	
	17			189	45		21
65		32	49			10	
	17			202	32		32
78		40	189			12	
	16			141	32		21
118		52	141			12	
	15			266	32		21
93		45	189			10	
	15			141	32		20
75		32	240			10	
	14			76	26		17
141		32	141			19	
	13			78	32		15
118		31	163			17	
	12			153	21		13
62		26	214			13	
	13			97	17		12
40		26	88			17	
	13			118	13		12
32		25				9.4	
	19			165	17		12
26		25	148			8.5	
	45			70	15		10
17		32	141			7.0	
	25			32	13		10
			141			21	

c.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.
17				404	165		9.7
			50			24	
45				306	143		13
	240		40			17	
29				279	120		21
	50		50			19	
24				266	120		12
	50		214			19	
21				214	89		17
	45		240			16	14
32				64	80		13
	32	120	165			16	
32				80	80		13
	22	214	143			12	
26				62	99		8.5
	17	80	99			15	
26				120	72		7.0
	15	143	80			13	
32				214	32		7.0
	10	214	50			13	
26				165	64		8.5
		143	214			13	
25				279	56		5.8
		132	240			15	
22				214	50		9.7
		110	279			10	
24				143	32		9.4
		80	334			10	
26				120	26		13
		56	279			10	
					80		

Winter flow.—Stage-discharge relation not affected by ice.

Diversions.—None.

Regulation.—None.

Accuracy.—Results excellent except for short periods when there may have been a small amount of leakage under weir. Practically no diurnal fluctuation.

Cooperation.—Gage-height record furnished by Portland Railway, Light & Power Co.

Discharge measurements of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	I. L. Collier............	0.72	53	Aug. 27	Paulsen and Jennings..	0.88	64
Apr. 15	Parker and Paulsen....	1.07	84	30	C. G. Paulsen..........	.90	66
June 2	C. G. Paulsen..........	1.30	114				

Daily discharge, in second-feet, of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	56	78	78	47	37	33	48	68	117	99	78	64
2	57	105	78	45	37	33	64	68	111	105	78	64
3	57	186	73	47	36	33	88	68	105	111	78	64
4	54	211	68	46	36	34	105	68	99	111	78	64
5	53	211	68	45	36	34	105	68	105	111	73	59
6	52	186	68	45	36	34	105	68	111	111	73	59
7	51	163	64	45	36	34	105	73	117	111	73	56
8	50	149	64	45	36	34	99	78	117	111	68	57
9	50	130	59	44	34	33	99	83	111	111	68	59
10	53	117	59	45	34	33	88	94	99	99	68	56
11	57	130	57	45	34	33	88	94	94	88	68	54
12	64	149	55	45	34	33	88	88	88	88	68	55
13	68	220	54	45	35	33	88	88	83	83	64	54
14	68	247	54	45	34	34	88	83	83	78	68	50
15	68	202	53	45	33	37	88	78	88	83	64	50
16	68	170	52	44	33	40	83	78	88	83	68	50
17	68	149	50	42	34	40	83	78	88	88	68	50
18	68	130	50	42	34	42	87	78	88	83	64	49
19	78	123	50	42	34	42	94	88	88	83	68	48
20	78	111	48	41	34	42	94	88	88	83	68	48
21	83	111	47	40	33	42	94	88	88	88	68	47
22	78	105	46	39	33	42	88	88	88	88	68	47
23	73	99	46	39	33	43	83	83	88	88	68	45
24	68	99	46	38	33	43	83	83	94	83	68	44
25	68	99	46	38	33	42	78	83	94	83	68	44
26	64	94	46	37	33	42	78	83	88	83	68	43
27	64	88	47	37	33	42	73	88	88	78	68	42
28	64	88	47	37	33	42	73	95	88	78	68	42
29	64	83	47	36	....	42	73	102	88	73	68	40
30	64	83	47	36	....	44	73	110	94	78	68	39
31	73	....	46	37	....	44	....	117	....	78	68	....

Note.—Discharge determined from a rating curve well defined between 50 and 250 feet.

outlet of Packwood Lake, near Lewis, Wash., for the ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	83	50	63.9	3,930	A.
....	247	78	137	8,150	A.
....	78	46	55.3	3,400	A.
....	47	36	42.1	2,590	A.
....	37	33	34.3	1,900	A.
....	44	33	38.0	2,340	A.
....	105	48	86.1	5,120	A.
....	117	68	83.8	5,150	A.
....	117	83	95.5	5,680	A.
....	111	73	90.9	5,590	B.
....	78	64	69.4	4,270	A.
....	64	39	51.4	3,060	B.
....	247	33	70.7	51,200	

AT MOUTH, NEAR LEWIS, WASH.

., R. 9 E. Willamette meridian, a quarter of a mile
trail bridge, and two miles northeast of Lewis, in

uare miles (measured on Pl. I, Water-Supply Paper

21, 1907, to January 22, 1913, and March 11, 1913, to
he station was discontinued.

8.0 feet, on right bank, a quarter of a mile below
read to hundredths twice a week October 1 to Novem-
nuary 23, April 24 to September 30, and once daily
22 and January 25 to April 18, by J. L. Jennings.

Made from cable at gage or by wading.

e boulders; probably permanent. One channel at
ow determined October 4, 1914, gage height —1.0 foot

aximum stage recorded during year, 1.7 feet at 8.30
arge, 358 second-feet); minimum stage recorded, 0.25
e, 40 second-feet).

ge recorded, 4.00 feet March 15 and 16, 1908 (discharge,
um stage recorded, 0.20 foot from September 8 to 19
ovember 3, 1911 (discharge, 36 second-feet).

ge relation probably not affected by ice; open-channel
icable.

Creek at mouth, near Lewis, Wash., during the year ending Sept. 30, 1015.

age eight.	Discharge.	Date.	Made by—	Gage height.	Discharge.
Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
0.50	62	June 4	C. G. Paulsen..........	0.86	111
.82	106	Aug. 28	.....do..................	.58	68

Daily discharge, in second-feet, of Lake Creek at mouth, near Lewis Wash., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	62	150	94	58	51	40	71	82	170	115	84	70
2	62	225	90	60	48	43	80	81	145	122	83	69
3	62	290	87	60	54	42	138	80	125	127	82	68
4	60	330	77	60	54	45	198	80	108	127	80	67
5	59	330	78	60	54	47	198	80	114	127	80	65
6	58	275	75	62	55	51	198	80	130	127	80	63
7	58	227	72	65	54	49	198	83	140	127	80	62
8	60	197	66	67	51	47	198	85	140	127	80	63
9	63	170	67	68	51	47	184	93	131	127	80	65
10	66	145	65	65	52	49	184	104	122	110	80	68
11	72	195	65	63	51	48	170	106	112	100	77	70
12	77	250	66	60	49	47	150	103	102	100	72	67
13	85	305	64	60	49	47	150	98	90	94	72	63
14	85	358	62	59	48	60	150	94	90	85	72	59
15	85	315	60	58	49	57	150	90	100	86	71	56
16	85	270	56	58	47	60	131	89	100	87	71	54
17	85	227	56	57	47	60	106	88	100	88	70	53
18	85	198	54	56	47	62	110	88	99	88	70	52
19	112	184	60	56	48	60	140	112	99	88	71	51
20	112	170	54	55	47	60	140	112	97	88	72	50
21	135	158	47	54	47	61	140	112	97	90	72	49
22	120	148	51	52	47	62	128	112	94	90	71	51
23	105	138	52	51	47	65	122	94	97	90	71	52
24	94	134	54	53	44	62	122	91	103	88	70	53
25	92	127	55	56	43	61	117	88	103	87	70	54
26	84	118	56	53	42	60	109	94	99	86	70	52
27	72	115	54	56	43	58	104	102	99	85	71	51
28	72	112	52	56	40	58	98	112	99	82	71	51
29	72	102	51	54	....	57	93	127	99	80	71	50
30	72	95	53	51	....	62	87	145	106	83	72	49
31	85	....	56	51	....	65	....	170	....	85	72	....

NOTE.—Discharge ascertained from a rating curve well defined between 40 and 600 second-feet. Gage read about twice a week Oct. 1 to Nov. 16, Dec. 23 to Jan. 24, and Apr. 19 to Sept. 30. Gage read daily Nov. 17 to Dec. 22 and Jan. 25 to Apr. 18, except the following days: Nov. 22, 27, 29; Dec. 6, 13, 14, 20; Mar. 7, 21, 28; Apr. 11, 14, and 15. Discharge for periods when gage was not read obtained by hydrographic comparison with record of Lake Creek at outlet of Packwood Lake, near Lewis.

Monthly discharge of Lake Creek at mouth, near Lewis Wash., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	135	58	80.5	4,950	B.
November	358	95	202	12,000	B.
December	94	47	62.9	3,870	B.
January	68	51	57.9	3,560	B.
February	55	40	48.5	2,690	B.
March	65	40	54.6	3,360	B.
April	198	71	139	8,270	B.
May	170	80	99.2	6,100	B.
June	170	90	110	6,550	B.
July	127	80	99.5	6,120	B.
August	84	70	74.5	4,580	B.
September	70	49	58.2	3,460	B.
The year	358	40	90.5	65,500	

E RIVER BASIN.

BELOW PROSPECT, OREG.

E., at Prospect power plant of California-Oregon
pect, and about 47 miles northeast of Medford; a
Creek and 2 miles above Middle Fork.

913, to September 30, 1915.
about 100 feet above power house. Read twice
A. Lower.
from cable about 500 feet above gage.
f large boulders; practically permanent.
um stage recorded during year, 4.9 feet March 20
tal, including estimated discharge of flume, 3,040
ecorded, 2.3 feet September 30 (discharge, 400
me, 457 second-feet).
corded, 5.0 feet at noon April 15, 1914 (discharge,
ing estimated discharge of flume, 3,120 second-
was that of 1915.
ation not affected by ice.
Power Co.'s flume diverts around this station;
n. (See p. 151.)

nent was made by P. V. Hodges:
2.35 feet; discharge, 419 second-feet.

ue River below Prospect, Oreg., for the years ending
t. 30, 1913–1915.

.	Aug.	Sept.	Day.	Aug.	Sept.
13.			1912-13.		
....	665	560	21	630	532
....	630	560	22	630	532
....	630	560	23	595	505
....	630	560	24	595	532
....	630	560	25	595	532
....	630	560	26	595	532
....	630	560	27	595	532
....	630	560	28	595	560
....	630	560	29	595	595
....	630	560	30	595	560
			31	595	....

Daily discharge, in second-feet, of Rogue River below Prospect, Oreg., for the years ending Sept. 30, 1913–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	532	532	700	1,740	860	2,250	1,100	1,520	1,300	780	560	505
2	560	560	740	2,020	860	2,020	1,100	1,580	1,250	740	560	505
3	560	532	700	1,690	820	1,690	1,150	1,690	1,150	820	532	505
4	560	532	665	1,580	820	1,690	1,470	1,690	1,150	700	532	505
5	532	820	665	1,580	780	2,020	1,740	1,580	1,150	700	532	505
6	560	2,020	665	1,580	740	2,020	1,640	1,580	1,150	630	532	505
7	1,250	1,580	665	1,800	700	2,020	1,580	1,580	1,250	665	532	505
8	950	1,150	665	1,800	700	2,020	1,580	1,640	1,300	665	532	630
9	665	950	665	1,580	700	2,020	1,740	1,580	1,250	700	505	560
10	595	905	665	1,420	780	2,020	2,020	1,580	1,150	630	505	532
11	560	1,100	630	1,250	820	2,020	1,910	1,580	1,150	630	505	505
12	560	860	630	1,150	820	2,130	1,800	1,580	1,250	630	505	505
13	630	1,050	630	1,150	860	2,130	2,020	1,740	1,150	630	505	505
14	630	1,100	630	1,150	820	2,020	2,250	1,800	1,150	630	505	505
15	560	860	630	1,050	820	1,910	2,740	1,800	1,150	595	505	665
16	630	630	630	1,050	820	1,910	2,490	1,690	1,050	595	505	860
17	595	630	665	1,000	860	2,020	2,130	1,690	1,000	595	505	1,050
18	560	665	630	950	950	2,020	2,020	1,580	950	595	505	780
19	595	665	630	860	1,050	2,020	2,020	1,520	950	595	505	700
20	560	665	630	860	1,050	2,020	2,020	1,520	860	595	505	780
21	560	630	630	950	1,150	2,020	2,020	1,690	860	595	505	630
22	560	595	630	1,360	1,150	2,020	1,800	1,580	860	595	505	560
23	560	700	630	1,250	1,100	2,020	1,800	1,580	820	560	505	532
24	560	740	630	1,360	1,100	1,910	1,740	1,580	1,150	560	505	532
25	532	740	630	1,360	1,580	1,690	1,640	1,800	950	560	505	505
26	560	1,100	630	1,470	1,470	1,580	1,580	1,470	950	560	505	560
27	560	1,150	630	1,250	1,470	1,470	1,520	1,420	860	560	505	532
28	532	820	630	1,150	2,250	1,360	1,420	1,360	780	560	505	505
29	532	950	560	1,050	....	1,250	1,360	1,250	780	560	505	505
30	532	860	595	1,050	....	1,200	1,360	1,250	780	560	505	505
31	532	....	1,580	950	....	1,150	....	1,250	....	560	505	....
1914–15.												
1	505	700	505	505	1,470	740	1,580	1,150	1,300	560	465	430
2	630	740	505	505	1,360	740	1,800	1,050	1,300	560	465	430
3	740	700	505	505	1,250	740	2,020	1,050	1,150	560	465	430
4	630	630	505	595	950	740	1,800	1,000	1,150	560	465	430
5	560	595	505	560	860	740	1,640	950	1,100	560	465	430
6	532	630	505	560	780	700	1,580	1,000	1,050	560	465	430
7	532	595	505	560	780	665	1,580	950	1,050	665	465	430
8	595	560	505	665	740	665	1,520	1,050	950	560	465	430
9	560	560	505	630	740	665	1,360	1,100	860	630	465	430
10	700	560	505	595	700	665	1,470	1,200	860	560	465	430
11	665	560	505	560	665	665	1,580	1,150	905	532	465	430
12	630	560	505	560	630	700	1,740	1,150	860	532	465	430
13	595	700	485	560	630	1,050	1,800	1,250	780	532	465	430
14	595	630	465	630	595	1,420	1,580	1,200	780	532	448	430
15	532	560	465	560	595	1,250	1,470	1,100	780	505	448	430
16	532	560	505	532	630	1,250	1,580	1,050	780	505	448	415
17	665	560	465	505	665	1,300	1,640	1,150	740	505	448	430
18	700	560	465	532	700	1,420	1,690	1,580	700	505	448	430
19	2,250	560	485	532	740	1,250	1,800	1,640	700	505	430	430
20	1,360	560	505	560	780	1,420	1,800	1,420	665	485	430	415
21	1,150	560	465	532	740	1,420	1,690	1,470	630	485	430	415
22	905	532	505	505	740	1,640	1,520	1,360	630	485	430	430
23	780	532	505	505	700	1,800	1,420	1,360	630	485	430	430
24	780	505	505	505	700	1,800	1,300	1,800	630	485	430	430
25	700	532	505	560	740	1,640	1,250	1,690	630	485	465	415
26	700	505	560	505	700	1,420	1,300	1,690	630	485	430	415
27	630	505	505	505	740	1,360	1,360	1,640	595	465	430	415
28	630	532	505	532	820	1,420	1,360	1,740	595	485	430	415
29	595	532	505	560	....	1,470	1,420	1,580	560	465	430	415
30	595	505	505	595	....	1,420	1,250	1,470	560	485	430	400
31	595	....	505	630	....	1,580	....	1,360	....	485	430	....

NOTE.—Discharge determined from rating curve well defined between 400 and 3,000 second-feet, by measurements made in 1916 and 1917.

Prospect, Oreg., for the years ending Sept. 30, 913–1915.

ischarge in second-feet.				Run-off (total in acre-feet).	Accuracy.
ver.		Canal mean.	Mean total.		
mum.	Mean.				
595	635	120	755	43,400	B.
505	569	120	689	41,000	B.
532	602	120	722	44,400	B.
532	870	120	990	58,900	B.
560	674	120	794	48,800	B.
860	1,310	120	1,430	87,900	B.
700	996	120	1,120	62,200	B.
1,150	1,860	120	1,980	122,000	B.
1,100	1,760	120	1,880	112,000	B.
1,250	1,570	120	1,690	104,000	B.
780	1,050	130	1,180	70,200	B.
560	624	130	754	46,400	B.
505	514	130	644	39,600	B.
505	583	130	713	42,400	B.
505	1,030	123	1,150	839,000	
505	728	130	858	52,800	B.
505	577	130	707	42,100	B.
465	499	140	639	39,300	B.
505	553	140	693	42,600	B.
595	791	150	941	52,300	B.
665	1,150	170	1,320	81,200	B.
1,250	1,560	170	1,730	103,000	B.
950	1,300	170	1,470	90,400	B.
560	818	165	983	58,500	B.
465	523	163	686	42,200	B.
430	449	162	611	37,600	B.
400	425	153	578	34,400	B.
400	781	154	935	676,000	

R NEAR TOLO, OREG.

V., at Raygold, just below dam and power house ., 1¼ miles below Tolo, 7 miles above Gold Hill, Creek.

.

5, to September 30, 1915.

erred to vertical staff bolted to concrete pier of der, F. H. Farrar.

rom cable 300 feet below gage.

oulders; practically permanent. One channel

n stage during year from water-stage recorder, discharge, 15,400 second-feet); minimum stage foot during the night of August 10 to Sepfeet).

orded, 20.00 feet at 7.30 a. m., November 23, tension of rating curve as 60,000 second-feet);

ion unaffected by ice.

rrigated from Rogue River and its tributaries.

d by changes of load on power plant just above

llent since recorder was installed; fair previous

Discharge measurements of Rogue River near Tolo, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 13	J. E. Stewart	2.04	2,300
Sept. 16	P. V. Hodges	.94	1,220
16	....do	.58	906

Daily discharge, in second-feet, of Rogue River near Tolo, Oreg., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,260	1,300	1,350	1,220	6,020	2,720	3,130	2,400	2,890	1,410	1,200	1,090
2	1,170	1,350	1,350	1,350	9,700	2,440	3,270	2,240	2,760	1,420	1,030	1,150
3	1,260	1,400	1,540	1.350	5,800	2,300	3,340	2,080	2,630	1,390	1,060	1,120
4	1,350	1,440	1,490	1,540	4,030	2,300	3,410	1,950	2,500	1,460	1,060	1,130
5	1,350	1,400	1,440	1,540	3,020	2,580	3,480	1,870	2,380	1,430	1,070	1,020
6	1,350	1,740	1,400	1,640	2,720	2,300	3,190	1,860	2,250	1,470	1,070	960
7	1,440	1,690	1,350	1,590	2,440	2,180	3,190	1,850	2,120	1,690	1,040	980
8	1,260	1,690	1,400	3,180	2,580	2,060	3,180	2,010	2,030	1,560	1,040	1,020
9	1,350	1,690	1,400	2,720	2,440	2,000	2,910	2,160	2,000	1,630	1,080	1.010
10	1,350	1,590	1,400	2,060	2,300	2,060	3,000	2,320	1,960	1,520	1,070	1,010
11	1,350	1,570	1,350	1,840	2,180	2,030	3,020	2,300	2,040	1,590	1,070	1,020
12	1,350	1,560	1,300	1,790	2,060	2,000	3,040	2,200	2,060	1,540	1,070	1,040
13	1,350	1,540	1,230	2,060	1,950	2,180	3,480	2,320	1,910	1,540	1,080	1,060
14	1,350	1,590	1,350	4,210	1,840	3,180	3,210	2,410	1,830	1,530	1,080	1,050
15	1,740	1,490	1,100	3,020	1,790	3,020	2,930	2,450	1,760	1,530	1,070	1,020
16	1,790	1,350	1,110	2,180	1,790	3,020	2,900	2,360	1,730	1,510	1,060	1,070
17	2,120	1,400	1,130	1,950	1,790	3,020	3,020	2,270	1,680	1,490	1,050	1,060
18	2,820	1,400	1,130	1,790	2,060	3,180	3,150	2,810	1,670	1,470	1,010	1,080
19	3,510	1,380	1,130	1,740	2,300	2,870	3,260	3,740	1,620	1,450	1,030	1,050
20	3,340	1,350	1,110	1,740	2,370	2,870	3,330	3,350	1,590	1,430	1,020	1,040
21	2,440	1,400	1,140	1,690	2,440	3,340	3,210	3,190	1,570	1,420	1,040	1,040
22	2,120	1,440	1,170	1,640	2,240	3,510	2,990	3,070	1,550	1,400	1,060	1,030
23	1,790	1,490	1,170	1,640	2,300	3,680	2,780	2,950	1,550	1,380	1,000	1,020
24	1,790	1,540	1,170	1,540	2,300	3,840	2,700	3,510	1,470	1,360	1,000	1,040
25	1,640	1,260	1,170	1,590	2,720	3,630	2,630	3,500	1,530	1,340	980	1,010
26	1,540	1,220	1,170	1,560	2,580	3,410	2,560	3,550	1,580	1,320	1,000	990
27	1,490	1,220	1,170	1,540	2,440	3,300	2,560	3,600	1,500	1,290	1,030	1,000
28	1,490	1,300	1,220	1,490	2,870	3,200	2,560	3,700	1,500	1,320	1,050	1,040
29	1,490	1,490	1,170	1,740	....	3,090	2,660	3,570	1,470	1,300	1,090	1,000
30	1,400	1,400	1,130	1,740	....	2,940	2,570	3,250	1,420	1,360	1,100	1,000
31	1,400	....	1,130	1,790	....	3,220	....	3,050	....	1,370	1,100	....

NOTE.—Discharge determined from a rating curve well defined between 900 and 5.000 second-feet. Gage records from Gurley Simplex recorder Oct. 15 to Mar. 22; from Friez recorder (with use of integrator) Mar. 23 to Sept. 30. One reading daily on staff gage Oct. 1-14. Discharge interpolated Nov. 11-12, Dec. 23-25, June 2-6, July 16-25, and Sept. 20-21.

Monthly discharge of Rogue River near Tolo, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	3,510	1,170	1,690	104,000	B.
November	1,740	1,220	1,460	86,900	A.
December	1,540	1,100	1,250	76,900	A.
January	4,210	1,220	1,890	116,000	A.
February	9,700	1,790	2,900	161,000	A.
March	3,840	2,000	2,820	173,000	A.
April	3,480	2,560	3,020	180,000	A.
May	3,740	1,850	2,710	167,000	A.
June	2,890	1,420	1,880	112,000	A.
July	1,690	1,290	1,450	89,200	B.
August	1,200	980	1,050	64,600	A.
September	1,150	960	1,040	61,900	B.
The year	9,700	960	1,920	1,390,000	

R CO.'S FLUME NEAR PROSPECT, OREG.

E., at lower end of power flume, just above the
v Prospect.
3, to September 30, 1915.
k on right side of flume, about 500 feet above
915. Gage 1 mile above forebay used August 1,

from collar of flume.
ume at the end of which there is a free fall into

ation never affected by ice.

s flume diverts water from Rogue River in the
delivers it to the power plant in the NW. ¼ sec.
about 500 feet is obtained.

-Oregon Power Co.'s flume near Prospect, Oreg.,
years ending Sept. 30, 1913–1915.

Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Sec.-ft.	1914-15.		*Feet.*	*Sec.-ft.*
121	Aug. 17	F. F. Henshaw.........	2.35	161
	17	do..................	2.35	164
	Sept. 22	P. V. Hodges..........	2.19	143
130				

d gage about midway of flume.

lifornia-Oregon Power Co.'s flume near Prospect,
year ending Sept. 30, 1915.

y.	Aug.	Sept.	Day.	Aug.	Sept.
....	....	157	21.............	157	150
....	....	150	22.............	157	144
....	....	144	23.............	157	157
....	....	150	24.............	157	157
....	....	157	25.............	164	157
....	....	157	26.............	164	150
....	....	157	27.............	157	150
....	164	157	28.............	157	144
....	164	144	29.............	164	144
....	170	144	30.............	164	157
			31.............	157	....

g curve well defined between 120 and 299 second-feet. Dis-
gage, as stage-discharge relation was affected by baffle board
mselves are somewhat uncertain. Monthly mean discharges
order to complete the total run-off for the river station. (See

gon Power Co.'s flume near Prospect, Oreg., for
ending Sept. 30, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accu-racy.
	Maximum.	Minimum.	Mean.		
....	170	167	162	4,470	A.
....	157	144	153	9,100	A.

SOUTH FORK OF BIG BUTTE CREEK NEAR BUTTE FALLS, OREG.

Location.—In the SE. ¼ sec. 11, T. 35 S., R. 2 E., at the covered highway bridge about a mile above Butte Falls, Jackson County, and about 2 miles above junction of North and South forks.

Drainage area.—Not measured.

Records available.—September 20, 1910, to October 5, 1911, and August 5 to October 10, 1915.

Gage.—Vertical staff on pier near left bank; read about three times a week. Gage reader, O. B. Morris.

Discharge measurements.—Measurements in 1915 made by wading.

Channel and control.—Rocks and gravel; may shift.

Extremes of discharge.—Maximum stage recorded during period August 19 to October 10, 1915, 1.43 feet August 28, September 11 to 20, and September 25 (discharge, 95 second-feet); minimum stage recorded, 1.41 second-feet August 5, 19 to 22, 26, and September 23 (discharge, 85 second-feet).

1910–11 and 1915: Maximum stage recorded, 2.5 feet January 20, 1911 (discharge, 800 second-feet); minimum is that of 1915.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—A small area of land is irrigated above the station.

Regulation.—None.

Accuracy.—Results considered good.

Discharge measurements of South Fork of Big Butte Creek at Butte Falls, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 5	R. P. Cowgill	1.41	81.4
19	.....do	1.41	102
Sept. 22	P. V. Hodges	1.42	92.6

Daily discharge, in second-feet, of South Fork of Big Butte Creek near Butte Falls, Oreg., for the period Aug. 5 to Oct. 10, 1915.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1		90		11		95		21			
2			90	12				22	85	90	
3		90		13		95		23		85	
4			90	14				24	90		
5	85	90		15		95		25		95	
6				16				26	85		
7			90	17		95		27		90	
8				18				28	95		
9		90		19	85			29		90	
10			90	20	85	95		30	90		
								31			

Note.—Discharge determined from a fairly well-defined rating curve; given only for days on which gage was read.

LITTLE BUTTE CREEK NEAR EAGLE POINT, OREG.

Location.—In the SE. ¼ sec. 35, T. 35 S., R. 1 W., at H. B. Tronson's fruit ranch, 1½ miles above Eagle Point, Jackson County.

Drainage area.—336 square miles.

Records available.—July 13, 1907, to September 30, 1915.

Gage.—Vertical staff spiked to alder trees on left bank; read daily. Gage reader, H. B. Tronson.

ade from cable suspension bridge 40 feet above gage
low water.

at measuring section; solid rock control.

imum stage recorded during year, 4.2 feet during
arge, 1,420 second-feet); minimum stage recorded,
13 to 20 (discharge, 7 second-feet).

ge recorded, 10.6 feet February 17, 1912 (discharge,
a is that of 1915.

relation unaffected by ice.

low-water flow diverted above this station. The
main canal of the Rogue River Valley Canal Co.,
for Medford (about 7.5 second-feet), Eagle Point
several hundred acres along the creek. The record
ppropriated flow and return water.

of storage is developed at Fish Lake, but was not

good except for extremely low water.

*Butte Creek near Eagle Point, Oreg., during the year
nding Sept. 30, 1915.*

e it.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
1	139	Aug. 3	R. P. Cowgill..........	−0.10	6.2
2	18.4	Sept. 19	P. V. Hodges..........	.15	15.3

*Little Butte Creek near Eagle Point, Oreg., for the year
ending Sept. 30, 1915.*

an.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
73	950	176	220	113	220	31	8	8
73	656	162	220	113	220	31	7	8
73	388	149	220	113	205	31	7	10
73	236	205	251	113	162	31	8	11
73	149	190	236	113	124	31	8	12
73	136	162	220	113	93	33	8	13
73	136	136	220	113	83	54	8	14
136	124	136	236	103	83	49	8	14
113	149	124	236	103	83	41	8	15
93	136	124	220	103	83	38	8	16
83	136	124	220	103	93	36	8	16
93	136	124	190	103	93	33	8	16
113	136	176	190	113	93	33	7	18
251	136	190	190	124	83	31	7	18
176	113	162	176	113	73	29	7	18
149	103	162	176	113	54	24	7	18
124	93	162	162	113	49	21	7	17
93	93	176	162	251	44	20	7	14
73	113	190	162	370	44	19	7	14
73	176	220	162	316	44	19	7	14
83	162	220	162	316	41	19	8	14
83	136	251	162	283	41	19	8	14
73	136	251	162	283	41	18	8	14
73	113	251	162	300	41	18	8	14
73	124	236	162	283	38	18	8	14
73	124	205	149	283	38	18	8	14
73	162	205	136	283	36	18	8	14
73	236	220	136	267	33	17	8	17
73	....	251	124	267	33	14	8	18
73	....	220	124	251	31	12	8	18
73	....	236	....	251	....	10	8	....

ting curve well defined between 30 and 600 second-feet and fairly

Monthly discharge of Little Butte Creek near Eagle Point, Oreg., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	370	49	99.4	6,110	B.
November	83	64	76.9	4,580	B.
December	73	73	73.0	4,490	B.
January	251	73	93.7	5,760	B.
February	950	93	196	10,900	B.
March	251	124	187	11,500	B.
April	251	124	185	11,000	B.
May	370	103	190	11,700	B.
June	220	31	80.0	4,760	B.
July	54	10	26.3	1,620	B.
August	8	7	7.68	472	C.
September	18	8	14.5	863	B.
The year	950	7	102	73,800	

ROGUE RIVER VALLEY CANAL AT INTAKE, NEAR LAKE CREEK, OREG.[1]

Location.—In the SE. ¼ sec. 20, T. 36 S., R. 2 E., 100 feet below intake, and about a mile east of Lake Creek, Jackson County.

Records available.—April 1 to September 30, 1914; April 1 to October 15, 1915.

Gage.—Vertical staff on left bank just below fish screen; read about three times a week. Gage reader, Will Mann.

Discharge measurements.—Made by wading.

Channel and control.—Earth section; apparently changes slightly.

Extremes of discharge.—Maximum stage recorded during irrigating seasons 1914 and 1915, 2.00 feet July 20, 1915 (discharge, 34 second-feet); canal dry during winter.

Accuracy.—Results considered fair.

Rogue River Valley canal diverts water from the right bank of North Fork of Little Butte Creek in sec 20, T. 36 S., R. 2 E., to irrigate lands in the drainage basin of Bear Creek.

Discharge measurements of Rogue River Valley canal at intake, near Lake Creek, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 30	R. P. Cowgill	1.45	16.3	Aug. 1	R. P. Cowgill	1.82	25.7
May 13	do	1.67	23.0	Sept. 18	P. V. Hodges	1.80	16.0

---

[1] Known as Rogue River Valley canal near Brownsboro, Oreg., in report for 1914.

Rogue River Valley canal at intake near Lake Creek, e period Apr. 1 to Oct. 15, 1915.

ept.	Oct.	Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
23	14	16....	15	20	24	28	24	18	......
22	14	17....	15	16	25	28	24	18	......
22	14	18....	15	18	26	27	24	19	......
22	14	19....	15	20	27	30	24	18	......
23	14	20....	15	20	28	34	24	16	......
24	13	21....	15	21	28	31	25	16	......
23	12	22....	15	21	28	28	26	16	......
22	13	23....	15	21	28	28	26	16	......
21	14	24....	15	21	28	28	26	16	......
21	14	25....	16	22	28	28	25	16	......
		26....	16	22	28	28	24	16	......
20	14	27....	16	24	28	28	24	15	......
20	14	28....	16	26	28	28	24	15	......
19	13	29....	16	25	28	27	24	15	......
19	12	30....	16	24	28	27	23	14	......
18	12	31....	......	21	......	27	23	......	......

fairly well defined rating curve Apr. 1 to July 24 and Aug. 6–13 ntrol for rest of period. Gage read about every other day; disge was not read.

Valley canal at intake, near Lake Creek, Oreg., for the d Apr. 1 to Oct. 15, 1915.

	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
....	16	14	14.8	881	B.
....	28	16	21.5	1,320	B.
....	28	22	25.4	1,510	B.
....	34	22	28.6	1,760	C.
....	27	23	24.8	1,520	C.
....	24	14	18.8	1,120	C.
....	14	12	13.4	399	C.
....	....	....	....	8,510	

EY CANAL NEAR BROWNSBORO, OREG.

6 S., R. 1 E., about 200 feet above the head of Bradheast of Brownsboro, Jackson County.

September 30, 1913; April 27 to October 15, 1915.

ottom of canal. Gage reader, Will Mann.

ade by wading near gage.

ock control at head of drop; aquatic plants may grow ge and affect stage-discharge relation.

imum stage recorded during period of record in arge, 24 second-feet); canal dry during winter.

air.

rigated between the intake of the canal and this

River Valley canal near Brownsboro, Oreg., during ar ending Sept. 30, 1915.

Made by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	1.24	12.9
....	1.45	18.9
....	1.35	12.8

Daily discharge, in second-feet, of Rogue River Valley canal near Borwnsboro, Oreg, for 1915.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	....	14	16	21	....	17	10
2	....	14	18	20	....	17	10
3	....	16	21	19	....	19	10
4	....	17	20	19	....	18	9
5	....	17	19	19	....	17	10
6	....	17	18	19	....	18	10
7	....	17	18	14	....	18	10
8	....	17	17	18	....	18	9
9	....	17	19	22	....	18	9
10	....	17	21	22	....	18	9
11	....	17	20	21	....	17	9
12	....	17	19	20	....	16	9
13	....	17	19	19	....	17	9
14	....	17	20	20	17	16	9
15	....	17	21	21	17	14	9
16	....	17	20	22	17	14	....
17	....	19	19	24	16	14	....
18	....	21	19	23	16	14	....
19	....	18	19	22	16	13	....
20	....	14	22	22	16	13	....
21	....	16	22	22	16	13	....
22	....	19	22	22	17	13	....
23	....	19	22	22	19	13	....
24	....	19	22	....	21	12	....
25	....	19	22	....	19	12	....
26	....	19	12	....	17	12	....
27	13	19	24	....	17	12	....
28	13	19	22	....	17	11	....
29	13	19	22	....	17	10	....
30	14	18	22	....	17	10	....
31	....	17	....	....	17	....	....

NOTE.—Discharge determined from a fairly well-defined rating curve Apr. 27 to Aug. 20, and by indirect method for shifting control thereafter. Gage read about every other day; discharge interpolated for intervening days. Mean discharge July 24 to Aug. 13 estimated at 20 second-feet.

Monthly discharge of Rogue River Valley canal near Brownsboro, Oreg., for the period Apr. 27 to Oct. 15, 1915.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	21	14	17.4	1,070	B.
June	22	12	19.9	1,180	B.
July	24	14	20.4	1,250	C.
August	21	16	18.4	1,130	C.
September	19	10	14.8	881	C.
October 1-15	10	9	9.4	280	C.
The period				5,790	

BEAR CREEK AT MEDFORD, OREG.

LOCATION.—In the NW. ¼ sec. 30, T. 37 S., R. 1 W., just above the Main Street Bridge in Medford, Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 13 to September 30, 1915.

GAGE.—Vertical staff at southeast corner of Page theater building, on left bank. Gage reader, R. P. Cowgill.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading; conditions favorable.

CHANNEL AND CONTROL.—Channel of loose gravel; a concrete sewer passing under creek forms a partial control.

aximum stage recorded during period March 13 to
arch 31 (discharge, 209 second-feet); minimum stage
20 (discharge, 0.2 second-foot or less).

bove the station is irrigated from the flood waters of

ed excellent except for period during which stream

Creek at Medford, Oreg., during the year ending Sept. 30, 1915.

age ight.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
eet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
2.10	118	June 12	R. P. Cowgill	1.90	65.5
2.23	131	23	.....do	1.73	37.8
2.33	170	29	.....do	1.65	25.6
2.11	110	July 25	.....do	1.37	2.7
1.98	79.1	Sept. 14	P. V. Hodges	1.30	.2

of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1915.

	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	....	178	108	103	21	....	....
....	....	193	103	96	20	....	....
....	....	193	110	85	19	....	....
....	....	178	108	81	21	....	....
....	....	171	99	72	26	....	....
....	....	171	87	77	27	....	....
....	....	171	87	81	36	....	....
....	....	148	74	70	33	....	....
....	....	142	77	66	38	....	....
....	....	142	99	66	33	....	....
....	....	142	92	70	28	....	....
....	....	142	96	70	26	....	....
....	142	142	103	66	22	....	....
....	162	133	108	55	23	....	0.2
....	162	133	113	52	21	....	....
....	178	133	106	50	20	....	....
....	178	133	106	45	12	....	....
....	156	133	120	46	13	....	....
....	148	133	156	39	11	....	....
....	148	133	148	39	8.5	0.2	....
....	178	133	130	39	7.8	....	....
....	178	120	126	36	3.5	....	....
....	178	108	110	36	3.4	....	....
....	178	108	133	36	3.2	....	....
....	162	142	116	34	3.1	....	....
....	148	128	118	36	2.1	....	....
....	148	108	110	31	1.2	....	....
....	162	108	139	29	0.2	....	....
....	193	108	123	26	.2	....	....
....	193	108	113	22	.2	....	....
....	209	....	116	....	.2	....	....

a well-defined rating curve. Discharge interpolated June 23, 24, *Monthly discharge of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1915.*

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 13-31	209	142	168	6,350	A.
April	193	108	140	8,330	A.
May	156	74	111	6,820	A.
June	103	22	55.1	3,280	A.
July	38	.2	15.6	959	B.
August			a.2	12	C.
September			a.2	12	C.
The period				25,800	

a Estimated.

UMPQUA RIVER BASIN.

UMPQUA RIVER NEAR ELKTON, OREG.

Location.—In sec. 8, T. 23 S., R. 7 W., at the falls in the river, 4 miles south (by road) from Elkton, and 8 miles (by river) above Elk Creek.

Drainage area.—3,680 square miles.

Records available.—October 18, 1905, to December 31, 1906, and May 12, 1907, to September 30, 1915.

Gage.—Staff in five sections. Low-water section inclined, the others vertical. Datum lowered 0.52 foot September 2, 1910. Gage read twice daily by D. C. Higginbotham.

Discharge measurements.—Made from ferry 100 feet below gage.

Channel and control.—Gravel; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 12.0 feet at 7 a. m, February 3 (discharge, 33,100 second-feet); minimum stage recorded, 0.10 foot September 17 to 30 (discharge, 950 second-feet).

1905–1915: Maximum stage recorded, 38.5 feet (present datum) at 7 a. m. November 23, 1909; minimum stage occurred in 1915.

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—Practically none.

Regulation.—Practically none.

Accuracy.—Stage-discharge relation changed slightly between 1911 and 1914; records as published for 1913, in Water-Supply Paper 362, are probably slightly low. Records for 1914 and 1915 considered good except those for low water of 1914. which may be slightly too low.

The following discharge measurement was made by M. S. Kelley:

August 12, 1915: Gage height, 0.24 foot; discharge, 1,040 second-feet.

Umpqua River near Elkton, Oreg., for the years ending Sept. 30, 1914–15.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
3,100	17,100	26,200	6 800	4,560	3,290	2,150	1,240	1,040
2,000	16,400	22,000	6,400	4,230	2,990	2,020	1,240	1,040
,700	15,700	18,500	6,010	3,910	2,690	2,410	1,240	1,040
,100	15,000	17,100	6,010	4,390	2,690	2,150	1,240	1,040
2,000	14,400	20,200	6,800	4,560	2,990	1,900	1,140	1,040
,600	13,500	21,300	6,600	4,230	3,290	1,900	1,140	1,040
,500	12,300	17,800	6,010	4,730	4,230	1,670	1,140	1,040
7,100	11,100	15,700	5,630	5,080	6,600	1,670	1,140	1,040
,000	9,900	14,400	6,010	4,560	6,800	1,670	1,140	1,340
2,600	7,660	13,200	7,440	4,230	5,440	1,780	1,140	1,450
,400	7,440	12,000	10,500	3,910	4,900	1,670	1,140	1,240
,800	10,200	11,400	9,100	3,910	4.560	1,450	1,140	1,240
,100	9,600	10,800	8,600	4.730	4,230	1,450	1,140	1,140
2,300	9,100	9,100	8,120	4,730	3,910	1,670	1,140	1,140
,500	8,600	8,120	8,360	4,560	3,590	1,670	1,140	1,140
,700	8,360	7,660	17,400	4,230	3,290	1,450	1,140	1,340
,000	7,660	7,220	15,700	3,910	2,990	1,450	1,140	1,780
,800	6,800	6,800	12,000	3,910	2,690	1,340	1,140	2,840
,200	6,400	6,400	10,200	3,590	2,690	1,240	1,140	2,280
,100	6,010	6,200	9,100	3,910	2,410	1,240	1,140	1,900
,100	5,630	6,010	8,120	5,260	2,150	1,450	1,040	1,670
,100	5,260	5,630	7,220	6,010	2,280	1,240	1,040	1,900
,900	5,630	6,010	8,600	4,900	2,840	1,240	1,040	2,020
,700	6,400	5,630	8,120	4,560	3,290	1,450	1,040	1,670
,300	8,600	5,260	7,660	4,900	3,290	1,450	1,040	1,670
,100	10,800	4,900	7,220	6,200	2,990	1,340	1,040	1,560
,500	15,700	5,080	6,200	6,010	2,690	1,340	1,040	1,450
.100	20,200	4,900	5,630	5,260	2,410	1,240	1,040	1,450
,800	....	5,260	5,260	4,560	2,150	1,240	1,040	1,340
,500	....	5,820	4,900	3,910	2,150	1,240	1,040	1,240
,800	....	6,400	....	3,590	....	1,240	1,040	....
,750	4,560	8,600	6,010	3,440	7,220	1,670	1,140	1,040
,900	12,000	8,120	5,820	3,910	6,800	1,670	1,140	1,040
,010	29,100	7,220	6,400	3,910	6,400	1,670	1,140	1,040
,800	17,100	7,660	7,010	3,590	6,010	1,670	1,140	1,040
,200	14,700	8,600	8,120	3,290	5,630	1,900	1,140	1,040
,440	13,800	8,600	7,220	3,290	4,900	2,150	1,140	1,040
,800	13,200	7,660	6,200	2,990	4,230	1,900	1,140	1,040
,400	12,600	7,220	5,630	2,690	3,590	1,670	1,140	1,040
,200	12,000	6,800	5,260	2,690	3,290	1,450	1,140	1,040
,400	11,400	6,400	4,900	2,990	3,910	1,340	1,140	1,040
,700	10,800	6,010	4,900	2,990	4,230	1,450	1,140	1,040
,800	10,200	5,630	5,630	2,990	3,910	1,240	1,140	1,040
,200	9,600	5,260	6,400	3,290	3,590	1,140	1,140	1,040
,000	9,100	4,900	6,010	5,820	3,290	1,240	1,140	1,040
,400	8,600	6,010	5,630	6,400	2,990	1,450	1,140	1,040
,500	8,120	8,600	5,260	6,010	2,690	1,240	1,140	1,040
,400	7,660	9,600	4,900	6,010	2,410	1,240	1,140	950
,800	7,220	8,850	4,560	7,220	2,410	1,140	1,140	950
,000	6,400	7,660	4,230	11,100	2,990	1,240	1,140	950
,500	6,010	6,600	3,910	14,400	2,690	1,450	1,140	950
,600	6,010	6,010	4,390	12,000	2,550	1,450	1,140	950
,100	6,800	5,630	4,900	10,500	2,410	1,240	1,140	950
,120	7,890	6,010	4,560	9,100	2,150	1,240	1,140	950
,660	8,850	6,400	4,230	7,660	2,150	1,240	1,140	950
,220	8,600	6,400	3,910	8,120	2,150	1,140	1,140	950
,400	8,120	6,010	3,590	10,800	2,150	1,140	1,040	950
,010	8,120	5,630	3,290	9,100	1,900	1,240	1,040	950
,630	8,600	5,630	3,590	8,600	1,900	1,450	1,040	950
,260	....	6,400	3,590	8,360	1,900	1,240	1,040	950
,560	....	6,800	3,290	8,120	1,670	1,140	1,040	950
,560	....	6,400	....	7,660	....	1,140	1,040	....

m rating curve well defined below 40,000 second-feet, except for lefined.

Monthly discharge of Umpqua River near Elkton, Oreg., for the years ending Sept. 30, 1914–15.

[Drainage area, 3,680 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1913–14.							
October	5,630	1,140	2,200	0.598	0.69	135,000	B.
November	15,700	1,240	5,520	1.50	1.67	328,000	B.
December	14,700	2,840	6,080	1.65	1.90	374,000	B.
January	57,100	10,800	25,300	6.88	7.93	1,560,000	B.
February	20,200	5,260	10,400	2.83	2.95	578,000	B.
March	26,200	4,900	10,700	2.91	3.36	658,000	B.
April	17,400	4,900	8,060	2.19	2.44	480,000	B.
May	6,200	3,590	4,530	1.23	1.42	279,000	B.
June	6,800	2,150	3,420	.929	1.04	204,000	B.
July	2,410	1,240	1,560	.424	.49	95,900	B.
August	1,240	1,040	1,120	.304	.35	68,900	B.
September	2,840	1,040	1,440	.391	.44	85,700	B.
The year	57,100	1,040	6,690	1.82	24.68	4,850,000	
1914–15.							
October	22,000	1,240	4,180	1.14	1.31	257,000	B.
November	5,080	1,900	2,670	.726	.81	159,000	B.
December	9,600	2,410	5,010	1.36	1.57	308,000	B.
January	23,400	3,750	10,300	2.80	3.23	633,000	A.
February	29,100	4,560	10,300	2.80	2.92	572,000	A.
March	9,600	4,900	6,880	1.87	2.16	423,000	A.
April	8,120	3,290	5,110	1.39	1.55	304,000	A.
May	14,400	2,690	6,420	1.74	2.01	395,000	A.
June	7,220	1,670	3,470	.943	1.05	206,000	A.
July	2,150	1,140	1,410	.383	.44	86,700	A.
August	1,140	1,040	1,120	.304	.35	68,900	B.
September	1,040	950	998	.271	.30	59,400	B.
The year	29,100	950	4,790	1.30	17.70	3,470,000	

NORTH UMPQUA RIVER AT TOKETEE FALLS, OREG.

Location.—In T. 26 S., R. 5 E. (unsurveyed), half a mile above Toketee Falls, one-eighth mile below mouth of Clearwater River, 15 miles northwest of Diamond Lake, about 52 miles east of Hoaglin post office by trail, and 76 miles east of Roseburg, Douglas County.

Drainage area.—337 square miles (measured on topographic map).

Records available.—February 26, 1908, to July 20, 1909; December 19, 1914, to September 30, 1915.

Gage.—Stevens water-stage recorder on left bank, about one-eighth mile above bridge on Mountain Meadows trail. Vertical staff at same site and datum used 1908 and 1909.

Discharge measurements.—Made from cable about 75 feet below gage; good measuring conditions.

Channel and control.—Boulders and rock; probably permanent.

Extremes of stage.—Maximum stage recorded, 4.33 feet, January 21, 1909; minimum stage recorded, 1.40 feet, September 19 to 25, 29, and 30, 1915.

Winter flow.—Stage-discharge relation unaffected by ice, as most of the low-water discharge is from springs.

Diversions.—None.

Regulation.—None.

Cooperation.—Gage heights for 1908 and 1909 furnished by the Southern Pacific Co.

Determinations of daily and monthly discharge withheld for additional data.

mpqua River at Toketee Falls, Oreg., during the ling Sept. 30, 1915.

le by—	Gage height.	Dis-charge.
	Feet.	*Sec.-ft.*
....	1.61	633
....	1.49	622
....	1.42	596

istant forest ranger.

Ɉmpqua River at Toketee Falls, Oreg., for the years 30, 1908, 1909, and 1915.

	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
..	2.00	2.10	2.65	2.75	2.65	2.25	2.10
..	2.00	2.10	2.75	2.75	2.75	2.25	2.10
..	2.00	2.15	2.85	2.75	2.65	2.15	2.00
..	1.90	2.25	2.85	2.65	2.65	2.15	2.10
..	1.90	2.25	2.75	2.65	2.65	2.15	2.06
..	1.85	2.25	2.85	2.65	2.65	2.15	1.90
..	1.85	2.25	3.00	2.75	2.60	2.15	1.90
..	....	2.15	3.00	2.85	2.60	2.15	1.90
..	1.85	2.25	3.10	3.00	2.50	2.15	1.90
..	1.85	2.40	3.00	3.15	2.50	2.15	1.90
...	1.90	2.40	3.15	3.15	2.50	2.15	1.90
...	1.90	2.50	3.10	3.15	2.58	2.15	1.90
...	2.00	2.50	3.15	3.15	2.50	2.15	1.90
...	2.10	2.50	3.15	3.25	2.50	2.15	1.90
...	2.60	2.60	3.10	3.10	2.50	2.15	1.85
...	3.10	2.65	3.00	3.00	2.40	2.15	1.85
...	3.25	2.75	3.10	3.00	2.40	2.15	1.85
...	3.25	2.75	3.10	2.90	2.35	2.15	1.85
...	2.75	2.75	3.00	2.85	2.25	2.00	1.85
...	2.50	3.00	3.10	2.90	2.25	2.10	1.85
...	2.40	3.25	3.00	2.85	2.25	2.00	1.85
...	2.40	3.25	2.85	2.85	2.25	2.00	1.85
...	2.40	3.40	2.85	2.75	2.35	2.00	1.85
...	2.35	3.25	2.85	2.75	2.40	2.00	1.85
...	2.35	3.10	2.75	2.75	2.40	2.00	1.85
00	2.25	3.00	2.85	2.75	2.35	2.00	1.85
10	2.25	2.85	2.85	2.65	2.35	2.00	1.85
10	2.25	2.65	2.75	2.65	2.35	2.00	1.85
00	2.25	2.65	2.75	2.65	2.25	2.00	1.85
...	....	2.65	2.75	2.65	2.25	2.00	1.85
...	....	....	2.85	....	2.25	2.00	....

1

Daily gage height, in feet, of North Umpqua River at Toketee Falls, Oreg., for the years ending Sept. 30, 1908, 1909, and 1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1908–9.										
1	1.85	2.15	2.00	2.10	2.50	2.25	2.15	2.25	2.90	2.15
2	1.85	2.15	2.00	2.10	2.25	2.15	2.15	2.35	3.00	2.10
3	1.85	2.10	2.00	2.10	2.25	2.15	2.15	2.50	3.00	2.00
4	1.85	2.10	2.00	2.50	2.15	2.15	2.15	2.65	2.90	2.00
5	1.85	2.10	1.90	3.15	2.15	2.25	2.25	2.75	2.85	2.00
6	1.75	2.00	1.90	3.10	2.15	2.25	2.25	2.75	2.75	2.25
7	1.75	2.00	1.90	3.25	2.10	2.25	2.25	2.65	2.75	2.25
8	1.75	2.00	1.90	3.10	2.10	2.15	2.02	2.60	2.65	2.15
9	1.75	1.90	1.90	3.10	2.10	2.25	2.02	2.60	2.65	2.10
10	1.75	1.90	1.85	2.85	2.00	2.25	2.02	2.65	2.65	2.00
11	1.75	1.90	1.85	2.50	2.00	2.25	2.02	2.65	2.50	2.00
12	1.85	1.90	1.85	2.15	2.10	2.25	2.02	2.60	2.50	2.00
13	1.85	1.85	1.85	2.10	2.10	2.25	2.02	2.60	2.50	2.00
14	2.00	1.85	1.85	2.15	2.10	2.25	2.10	2.50	2.40	2.00
15	2.25	1.85	1.85	2.50	2.15	2.25	2.10	2.40	2.40	1.90
16	2.50	1.85	1.85	3.65	2.15	2.35	2.10	2.40	2.40	1.90
17	2.25	1.85	1.85	3.50	2.35	2.25	2.10	2.40	2.40	1.90
18	2.10	1.90	1.85	3.75	2.65	2.35	2.10	2.35	2.50	1.90
19	2.25	2.00	1.85	4.00	2.50	2.25	2.10	2.35	2.50	1.90
20	2.25	2.35	1.75	4.25	2.40	2.25	2.10	2.35	2.50	1.90
21	2.15	2.35	1.75	4.35	2.50	2.15	2.10	2.35	2.35	....
22	2.10	2.40	1.85	4.10	2.50	2.15	2.10	2.35	2.25	....
23	2.10	2.35	1.85	3.35	2.40	2.15	2.10	2.25	2.25	....
24	2.10	2.25	1.85	3.10	2.35	2.15	2.10	2.25	2.25	....
25	2.10	2.25	1.85	3.00	2.35	2.10	2.10	2.25	2.25	....
26	2.10	2.15	1.90	3.00	2.25	2.10	2.10	2.25	2.25	....
27	2.10	2.15	1.90	2.90	2.25	2.10	2.10	2.25	2.15	....
28	2.10	2.10	1.90	2.90	2.25	2.15	2.15	2.65	2.15	....
29	2.10	2.10	2.00	2.90	....	2.15	2.15	2.65	2.15	....
30	....	2.00	2.00	2.85	....	2.10	2.15	2.65	2.15	....
31	....	....	2.10	2.67	....	2.15	....	2.65	....	....

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Aug.	Sept.
1914–15.								
1	....	1.64	1.87	1.80	2.07	1.96	....	1.42
2	....	1.64	1.85	1.80	2.14	1.94	....	1.42
3	....	1.66	1.85	1.80	2.23	1.93	....	1.42
4	....	1.65	1.83	1.82	2.19	1.90	....	1.41
5	....	1.66	1.81	1.81	2.14	1.88	....	1.42
6	....	1.66	1.79	1.81	2.11	1.87	....	1.42
7	....	1.72	1.78	1.81	2.13	1.87	....	1.43
8	....	1.75	1.75	1.79	2.08	1.87	....	1.42
9	....	1.72	1.75	1.77	2.05	1.90	....	1.42
10	....	1.71	1.74	1.77	2.05	1.94	....	1.42
11	....	1.70	1.75	1.77	2.08	1.93	....	1.43
12	....	1.70	1.80	1.78	2.15	1.96	....	1.43
13	....	1.78	1.81	1.84	2.19	2.01	1.49	1.44
14	....	1.80	1.81	1.95	2.13	2.03	1.49	1.43
15	....	1.76	1.79	1.96	2.10	1.99	1.48	1.43
16	....	1.73	1.80	1.96	2.11	1.96	1.47	1.43
17	....	1.74	1.80	1.99	2.14	1.98	1.47	1.43
18	....	1.73	1.80	2.01	2.17	2.16	1.47	1.43
19	1.61	1.70	1.80	1.99	2.21	2.19	1.47	1.40
20	1.61	1.70	1.79	1.99	2.21	2.14	1.46	1.40
21	1.58	1.70	1.79	2.04	2.19	2.15	1.46	1.40
22	1.60	1.70	1.80	2.09	2.14	2.13	1.45	1.40
23	1.60	1.70	1.80	2.15	2.08	2.12	1.45	1.40
24	1.60	1.69	....	2.16	2.04	2.28	1.47	1.40
25	1.62	1.70	....	2.10	2.01	2.22	1.46	1.40
26	1.64	1.93	....	2.04	1.99	2.25	1.44	1.41
27	1.62	1.98	....	2.00	2.00	2.24	1.43	1.42
28	1.62	1.99	....	2.01	2.01	2.30	1.43	1.42
29	1.62	1.93	....	2.01	2.03	2.24	1.43	1.40
30	1.62	1.89	....	2.01	2.00	2.19	1.42	1.40
31	1.63	1.87	....	2.01	....	2.16	1.41	....

JA RIVER NEAR HOAGLIN, OREG.

R. 1 W., one-fourth mile above the forest boundary,
boat Creek, and 10 miles above Hoaglin post office,

les (measured on topographic map and Forest Service

20, 1911, to August 11, 1915 (fragmentary).
ank; read at irregular intervals.
ade from cable above gage.
and deep; practically permanent.
imum stage recorded during year, 5.8 feet February
extension of rating curve, 6,650 second-feet); mini-
et August 11 (discharge, 792 second-feet).
relation unaffected by ice.

excellent for days on which gage was read.
nished by United States Forest Service, S. C. Bart-

*Umpqua River near Hoaglin, Oreg., during the year
nding Sept. 30, 1915.*

Made by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
	2.12	964
	1.87	798
	1.73	727

*North Umpqua River near Hoaglin, Oreg., for the year
nding Sept. 30, 1915.*

ec.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.
		5,970	2,460				
		6,650		3,040			
		3,660					
	2,120						
						1,110	
			1,940	2,120			
		2,740					
							792
	1,940	1,940	1,720				
	3,930		2,820				
	2,320	2,390	2,390				
950	1,940						
		2,250					
			2,390		4,400		
	1,470						
		2,460					
,470							
	1,940						
,550							

ting curve well defined to 3,000 second-feet; given only for days

NORTH UMPQUA RIVER NEAR OAKCREEK, OREG.

Location.—In the NW. ¼ sec. 25, T. 26 S., R. 5 W., just below Sunshine ferry, 3 miles west of Oakcreek, about 5 miles east of the former station at Winchester, and about 9 miles northeast of Roseburg, Douglas County.

Drainage area.—1,260 square miles (measured on topographic maps and Forest Service map; revised since publication of Water-Supply Paper 394).

Records available.—September 6, 1905, to October 10, 1908; July 24, 1913, to September 30, 1915, when station was discontinued.

Gage.—Staff, lower part inclined, upper part vertical, on left bank; read daily. Gage reader, F. C. Lauer.

Discharge measurements.—Can best be made from Hughes ferry near Glide, about 8 miles above.

Channel and control.—Gravel and rock; somewhat shifting.

Extremes of discharge.—Maximum stage recorded during year, 10.1 feet at 8 a. m. October 19 (discharge, 19,600 second-feet); minimum stage recorded, 1.2 feet at 6 p. m. September 23 (discharge, 700 second-feet).

The records of maximum discharge for this station and also that at Winchester have been recomputed as follows, by means of flood measurements made in 1916:

Maximum recorded stages and corresponding discharge of North Umpqua River, 1906–1915.

Year ending Sept. 30—	Station.	Date.	Gage height.	Discharge.
			Feet.	*Sec.-feet.*
1906	Oakcreek	Jan. 16	12.5	29,900
1907	do	Feb. 4	21.2	67,900
1908	do	Dec. 22	17.7	52,300
1909	Winchester	Jan. 21	13.3	32,400
1910	do	Nov. 23, 2a. m.	28.1	92,000
1911	do	Nov. 28	15.5	41,000
1912	do	Jan. 12	16.5	44,800
1913	do	Mar. 30	12.5	29,300
1914	Oakcreek	Dec. 31	9.55	17,700
1915	do	Oct. 19	10.1	19,600

Minimum stage, 1905–1915, September 23, 1915.

Winter flow.—No ice ever forms at this station.

Diversions.—None.

Regulation.—None.

Accuracy.—Results considered excellent.

Discharge measurements of North Umpqua River near Oakcreek, Oreg., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 10	Henshaw and Lundgren	1.48	854
Feb. 7	J. C. Kuhns	15.40	40,800

Note.—Measurement Feb. 7, 1916, made at Winchester; inflow estimated at 500 second-feet was deducted to obtain discharge at the station.

North Umpqua River near Oakcreek, Oreg., for the year
nding Sept. 30, 1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
3,180	13,700	4,000	2,750	1,910	3,180	1,240	930	750
2,750	8,540	3,650	3,030	1,910	2,890	1,160	930	750
2,960	9,750	3,180	3,820	1,910	2,620	1,160	930	750
3,180	7,160	4,360	3,580	1,910	2,250	1,160	860	750
2,890	5,900	3,820	3,330	1,800	2,250	1,160	860	725
3,180	5,310	3,490	3,030	1,700	2,190	1,240	860	700
3,330	5,020	3,260	2,890	1,700	2,130	1,420	860	700
8,060	4,740	3,030	2,750	1,600	2,020	1,420	860	700
5,700	4,000	2,890	2,490	1,920	1,910	1,510	860	700
4,520	3,650	2,620	2,490	2,250	2,020	1,420	860	700
3,330	3,030	2,490	2,620	2,250	2,130	1,290	800	700
3,030	2,750	2,490	2,750	2,250	2,020	1,160	800	725
3,650	2,620	2,490	3,030	2,490	1,910	1,160	800	750
0,500	2,440	3,240	2,890	3,330	1,800	1,080	800	750
6,720	2,250	4,000	2,750	3,820	1,700	1,080	800	750
5,500	2,250	3,650	2,620	3,420	1,600	1,080	800	750
4,660	2,250	3,650	2,620	3,030	1,600	1,080	800	750
3,820	3,330	3,650	2,680	7,820	1,600	1,080	800	700
3,820	3,330	3,030	2,750	8,060	1,510	1,080	800	700
3,820	3,650	3,030	2,620	5,700	1,460	1,080	800	700
3,490	3,340	3,180	2,490	5,120	1,420	1,000	800	700
2,890	3,030	3,330	2,250	5,120	1,420	1,000	800	700
2,750	4,000	3,650	2,020	5,810	1,420	1,000	800	700
2,500	4,180	3,330	1,910	6,500	1,420	930	800	700
2,250	4,740	3,030	1,960	6,100	1,330	965	750	750
2,130	5,500	2,750	2,020	6,500	1,330	1,000	750	725
2,020	5,120	2,620	1,910	5,700	1,280	930	750	700
2,020	4,560	2,620	1,910	5,500	1,240	930	750	700
2,750	....	2,620	2,130	4,740	1,240	930	750	700
2,490	....	2,620	2,020	4,120	1,240	930	750	700
3,100	....	2,750	....	3,490	....	930	750	....

vell-defined rating curve; interpolated for Sundays.

ua River near Oakcreek, Oreg., for the year ending Sept.
30, 1915.

age area, 1,260 square miles.]

Discharge in second-feet.			Run-off.		
Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
1,080	2,850	2.26	2.61	175,000	A.
1,160	1,670	1.33	1.48	99,400	A.
1,080	1,650	1.31	1.51	101,000	A.
2,020	3,940	3.13	3.61	242,000	A.
2,250	4,650	3.69	3.84	258,000	A.
2,490	3,180	2.52	2.90	196,000	A.
1,910	2,600	2.06	2.30	155,000	A.
1,600	3,850	3.06	3.53	237,000	A.
1,240	1,800	1.43	1.60	107,000	A.
930	1,120	.889	1.02	68,900	A.
750	815	.647	.75	50,100	A.
700	719	.571	.64	42,800	A.
700	2,390	1.90	25.79	1,730,000	

MILL CREEK NEAR ASH, OREG.

Location.—In sec. 2, T. 23 S., R. 10 W., three-fourths mile below outlet of Loon Lake, 5 miles northwest of Ash post office, and about 12 miles south of Scottsburg, Douglas County.

Drainage area.—90 square miles (measured on maps prepared by J. G. Kelley).

Records available.—May 18, 1907, to September 30, 1912; April 20 to September 30, 1915.

Gage.—Stevens water-stage recorder on right bank. Gage reader, Richard Peterson. Vertical staff on lake was read 1907 to 1912, and for comparison in 1915 and 1916.

Discharge measurements.—Made from cable at gage, or by wading at low stages.

Channel and control.—Channel, gravel; control of boulders and bed rock about 85 feet below gage. Rock channel at lake outlet forms control for lake gage.

Extremes of discharge.—Maximum stage from water-stage recorder during period April 20 to September 30, 1915, 2.16 feet 3 to 9 a. m. May 20 (discharge, 394 second-feet); minimum stage from water-stage recorder, 0.32 foot at 2 p. m. September 26 (discharge, 4.2 second-feet).

1907–1912: Maximum stage recorded on lake gage, 21.4 feet November 23, 1909 (discharge, 10,000 second-feet); minimum stage recorded, 2.1 feet September 13 to 20 and September 25 to October 2, 1910 (discharge, 1.5 second-feet).

Winter flow.—Stage-discharge relation unaffected by ice.

Diversions.—None.

Regulation.—Some fluctuation at low water due to effect of wind on lake.

Accuracy.—Results considered good except for periods of extremely low water, for which they are only fair.

Discharge measurements of Mill Creek near Ash, Oreg., during the year ending Sept. 30, 1915.

[Made by M. S. Kelley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 15	....	164	Apr. 26	1.18	99.0
20	1.30	125	Aug. 6	.58	23.9

Daily discharge, in second-feet, of Mill Creek near Ash, Oreg., for the years ending Sept. 30, 1907–1912 and 1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1907.						1907.					
1	....	69	34	15	5.0	16	....	75	23	11	4.5
2	....	69	34	15	5.0	17	....	71	22	11	4.5
3	....	66	33	14	5.0	18	81	67	22	10	4.5
4	....	63	32	14	5.0	19	81	64	21	9	5.0
5	....	60	31	14	5.0	20	81	60	20	8	5.0
6	....	57	30	14	5.0	21	81	56	20	7	5.0
7	....	54	30	14	5.0	22	81	52	20	6	5.0
8	....	51	29	14	5.0	23	81	48	19	6	5.0
9	....	48	28	14	4.5	24	81	46	19	6	5.0
10	....	56	27	14	4.5	25	81	44	18	6	5.5
11	....	64	26	14	4.5	26	81	43	18	6	5.5
12	....	73	26	14	4.5	27	81	41	17	6	5.5
13	....	81	25	14	4.5	28	81	39	17	6	5.5
14	....	88	24	13	4.5	29	81	38	17	6	6.0
15	....	88	23	12	4.5	30	75	36	16	6	6.0
						31	72	....	16	6	......

Mill Creek near Ash, Oreg., for the years ending Sept. 1912 and 1915—Continued.

n.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
180	194	478	452	126	122	60	19	8
270	188	800	478	126	118	58	19	8
100	177	835	426	162	114	55	19	8
905	194	740	378	246	110	51	17	7
770	246	650	310	254	106	48	16	7
680	378	504	272	208	101	48	15	6
560	710	452	254	194	97	46	15	6
504	680	402	254	182	92	44	14	6
620	550	354	222	172	88	42	14	6
680	426	332	201	162	83	42	13	6
680	426	310	182	144	78	40	12	6
560	414	291	172	135	74	38	11	6
504	402	272	162	140	69	35	11	6
452	378	254	153	130	67	33	10	6
402	354	254	153	130	65	30	10	6
354	343	290	148	135	63	30	10	5.8
332	378	332	146	144	60	30	9	5.7
310	378	354	144	182	60	30	9	5.5
310	354	332	144	238	60	30	9	5.3
452	332	310	135	264	63	29	9	5.1
680	310	272	126	290	102	27	8	5.0
650	281	246	118	254	102	26	8	4.9
532	246	260	110	238	102	26	8	4.7
452	238	254	148	222	95	24	8	4.5
378	222	254	222	194	88	24	8	4.5
354	208	284	222	172	81	23	7	4.4
300	194	313	194	162	78	23	7	4.4
254	194	343	182	153	75	22	7	4.2
246	254	332	162	140	69	22	6	4.2
238	....	332	148	135	63	22	8	4.2
208	....	354	....	126	....	20	8	....
560	504	905	162	69	158	29	14	4.8
504	590	870	172	66	140	27	14	4.8
452	1,220	980	182	63	128	27	13	4.6
710	1,320	905	172	60	115	26	12	4.6
888	1,180	888	177	58	101	25	12	4.5
510	1,140	870	172	58	88	26	11	4.5
660	1,180	740	167	56	76	29	11	4.4
910	1,140	650	158	53	69	31	10	4.4
440	1,060	650	148	53	46	30	10	4.2
220	1,180	620	144	57	60	30	9	4.2
905	1,180	426	137	69	58	29	8	4.1
680	1,020	452	135	67	53	29	8	4.0
590	940	402	126	65	50	28	8	3.9
478	1,220	354	118	63	48	26	8	3.9
800	1,140	321	114	61	47	25	8	3.8
920	1,020	290	110	59	47	24	7	3.6
410	1,270	263	104	57	48	24	6	3.5
110	1,560	254	96	55	47	22	6	3.5
660	1,710	230	95	53	44	22	6	3.4
110	1,660	222	101	51	43	21	6	3.4
440	1,610	238	88	49	40	20	6	3.5
920	1,360	254	87	50	39	19	6	3.5
440	1,060	238	82	48	38	18	6	3.4
560	905	222	80	46	36	18	6	3.4
140	1,320	201	78	44	35	17	6	3.6
905	1,710	182	75	43	34	17	6	3.8
680	1,320	172	75	43	33	16	5	3.9
620	1,100	167	75	47	33	16	5	4.0
560	....	162	75	75	31	16	5	4.1
504	....	158	72	126	30	16	5	4.5
504	....	153	....	162	....	15	5	....

Daily discharge, in second-feet, of Mill Creek near Ash, Oreg., for the years ending Se 30, 1907–1912 and 1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1909–10.												
1	5	354	870	465	650	1,860	135	110	46	26	5.5	2
2	6	343	835	439	532	1,860	130	106	43	24	5.5	2.
3	8	272	740	343	452	1,360	172	102	43	23	5.5	2.
4	8	222	905	290	402	1,180	194	102	38	23	5.0	2.
5	9	182	870	254	366	870	201	98	38	23	5.0	2.
6	8	177	518	238	343	740	189	95	38	23	5.0	2.
7	8	182	560	263	321	620	177	95	36	22	5.0	2.
8	8	290	870	478	300	504	165	88	36	20	4.8	2.
9	7	620	1,410	590	290	452	153	81	34	20	4.8	2.
10	7	835	1,000	491	310	402	153	81	34	20	4.5	2.
11	6	1,020	1,000	426	343	354	194	81	34	18	4.5	1.
12	6	835	1,000	378	390	310	452	81	34	17	4.2	1.
13	6	605	1,510	332	402	272	439	78	34	17	4.2	1.
14	6	491	1,360	310	680	254	354	75	34	16	4.0	1.
15	6	402	980	310	870	230	300	69	34	14	4.0	1.
16	6	343	740	310	785	208	254	69	34	14	4.0	1.
17	6	310	590	378	710	194	230	63	32	12	4.0	1.
18	6	254	518	478	740	182	208	63	30	12	4.0	1.
19	6	354	402	835	1,040	172	194	60	30	11	3.8	1.
20	16	1,270	354	905	1,020	177	177	58	30	11	3.5	1.
21	40	1,420	310	770	870	188	167	58	34	11	3.5	1.
22	74	3,040	272	650	785	182	158	56	38	11	3.5	1.
23	75	10,000	254	650	835	194	148	53	38	11	3.2	1.
24	66	5,160	238	835	980	201	140	53	36	10	3.2	1.8
25	58	2,920	222	980	1,200	208	135	53	34	8	3.0	1.5
26	50	2,110	208	1,060	1,250	201	126	50	34	8	3.0	1.5
27	44	1,270	194	1,100	1,220	188	118	48	30	8	3.0	1.5
28	43	940	162	1,100	1,540	182	110	48	30	7	3.0	1.5
29	48	940	172	1,140	....	167	114	48	28	6	3.0	1.5
30	92	905	172	980	....	158	110	48	26	6	2.8	1.5
31	144	....	272	800	....	144	....	48	....	6	2.5	....
1910–11.												
1	1.5	8	1,610	650	905	224	75	90	131	38	7.0	3.0
2	1.5	8	980	650	940	206	68	90	121	36	6.4	3.0
3	1.8	8	870	532	940	190	68	90	112	34	6.0	2.9
4	3.5	7	1,410	452	800	174	68	90	102	32	6.0	2.9
5	6.0	6	1,270	402	710	167	98	90	94	30	6.0	3.2
6	11	6	940	354	800	160	98	98	86	28	5.8	3.7
7	11	12	710	310	710	174	94	98	82	26	5.8	4.5
8	11	58	605	266	710	206	90	98	78	25	5.5	5
9	14	254	650	288	620	224	82	148	78	24	5.5	5
10	14	254	620	560	560	244	116	174	72	22	5.2	5
11	14	590	560	650	504	244	266	174	68	22	5.0	5
12	14	504	478	650	560	224	452	160	65	21	5.0	6
13	20	310	402	560	620	206	452	148	59	20	4.8	11
14	26	206	354	452	740	190	426	136	56	19	4.8	17
15	30	190	310	402	680	174	402	131	54	18	4.8	18
16	26	98	288	354	620	160	378	112	51	17	4.5	19
17	23	86	402	414	560	167	354	112	51	16	4.2	20
18	26	78	452	2 010	590	154	321	190	48	16	4.2	20
19	26	78	402	3,640	620	142	299	1,060	46	15	4.0	17
20	23	90	343	2,920	532	126	266	980	44	14	4.0	16
21	23	148	310	2,160	478	116	224	680	44	12	3.9	13
22	20	590	266	1,220	426	107	206	532	42	12	3.9	12
23	18	905	244	870	378	107	174	426	40	12	3.8	10
24	17	1,270	244	680	332	107	160	378	38	11	3.8	10
25	16	800	266	620	310	107	148	310	38	10	3.6	9
26	14	504	266	620	288	107	131	266	36	10	3.5	9
27	12	402	288	590	266	98	121	224	36	10	3.5	11
28	11	1,660	288	980	244	90	116	190	38	9	3.4	13
29	11	3,160	288	1,100	....	82	107	160	38	8	3.4	13
30	10	2,410	288	870	....	78	98	148	40	8	3.2	12
31	8	....	402	870	....	75	....	136	....	8	3.1	....

f Mill Creek near Ash, Oreg., for the years ending Sept. 1–1912 and 1915—Continued.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
940	650	343	222	905	177	118	35	11
835	560	310	201	1,410	162	110	34	26
680	491	290	182	1,100	144	102	33	42
590	426	254	172	800	135	95	32	57
504	478	254	162	504	126	88	31	73
650	504	238	153	478	118	81	30	88
1,760	478	254	144	402	110	75	29	95
2,160	439	272	144	343	102	72	28	102
1,660	426	290	135	290	95	69	27	97
1,320	532	272	130	254	88	66	26	93
1,060	710	246	126	222	84	63	23	88
1,610	770	222	126	208	88	62	20	79
3,820	710	208	122	194	95	61	20	70
2,860	770	194	114	177	102	60	20	62
2,110	800	321	110	162	102	59	20	53
1,360	1,860	905	106	153	95	58	20	50
1,020	2,710	1,360	102	144	95	57	20	47
770	3,160	1,100	102	135	88	56	20	44
620	2,110	835	118	134	81	55	19	41
590	1,410	680	118	133	78	54	18	39
465	980	560	135	132	81	53	17	36
402	650	478	144	131	88	52	17	33
366	770	426	153	129	81	50	17	30
332	800	354	167	128	81	48	17	29
1,180	710	310	172	127	81	46	16	27
1,610	560	290	182	126	75	44	15	26
1,410	504	254	177	126	84	42	14	24
1,100	439	230	172	135	118	40	14	23
870	390	230	177	140	126	38	13	23
740	....	254	402	182	126	37	12	23
680	....	238	....	188	....	36	11	....

Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
		1915.						
30	9	16	......	211	102	41	17	6
30	9	17	......	199	99	40	17	6
28	9	18	......	211	95	40	16	6
27	8	19	......	302	92	41	16	6
25	8	20	126	386	88	40	15	5
24	8	21	124	346	85	38	15	5
24	8	22	120	306	82	37	15	5
22	7	23	114	277	78	36	15	5
22	7	24	110	268	75	35	14	4
22	7	25	108	286	72	35	12	4
22	7	26	102	302	69	33	11	4
21	7	27	102	330	65	33	11	5
20	7	28	101	354	62	34	11	5
19	7	29	97	342	57	32	10	6
19	6	30	97	312	56	32	10	6
		31	......	283	......	31	11	......

ows: May 18, 1907, to Nov. 10, 1910, and Jan. 13 to Sept. 30, 1912,
efined rating curve, based on measurements in 1907, 1915, and 1916;
ell-defined rating curve, which coincides with the other curve above
on three measurements made in 1910 and 1911; Apr. 20 to Sept. 30,
well-defined rating curve. Gage read at irregular intervals May to
1908, and July to September, 1912; discharge interpolated for days
ctically every day at other times except Oct. 7–12, 1909, Apr. 6–8,
erpolated), Dec. 10–12, 1910 (discharge estimated).

Monthly discharge of Mill Creek near Ash, Oreg., for the years ending Sept. 30, 1907–1912 and 1915.

[Drainage area, 90 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
May 18-31	81	72	79.9	0.888	.046	2,220	C.
June	88	36	58.9	.654	.73	3,500	B.
July	34	16	23.8	.264	.30	1,460	B.
August	15	6	10.5	.117	.13	646	B.
September	6.0	4.5	4.97	.055	.06	296	C.
The period						8,120	
1907–8.							
October	14	5	8.1	.090	.10	498	C.
November	1,270	10	225	2.50	2.79	13,400	B.
December	4,420	194	1,240	13.80	15.91	76,200	B.
January	1,270	208	546	6.07	7.00	33,600	B.
February	710	177	333	3.70	3.99	19,200	B.
March	835	246	380	4.22	4.86	23,400	B.
April	478	110	214	2.38	2.66	12,700	B.
May	290	126	179	1.99	2.29	11,000	B.
June	122	60	84.8	.942	1.05	5,050	B.
July	60	20	34.8	.387	.45	2,140	B.
August	19	6	11.1	.123	.14	682	C.
September	8	4.2	5.68	.063	.07	338	C.
The year	4,420	4.2	273	3.03	41.31	198,000	
1908–9.							
October	194	3.0	59.5	.661	.76	3,660	C.
November	753	32	174	1.93	2.15	10,400	B.
December	1,020	92	360	4.00	4.61	22,100	B.
January	2,920	452	1,280	14.2	16.37	78,700	B.
February	1,710	504	1,200	13.3	13.85	66,600	B.
March	980	153	434	4.82	5.56	26,700	B.
April	182	72	119	1.32	1.47	7,080	B.
May	162	43	62.1	.690	.80	3,820	B.
June	158	30	60.5	.672	.75	3,600	B.
July	31	15	23.2	.258	.30	1,430	C.
August	14	5	8.0	.089	.10	492	C.
September	4.8	3.4	3.99	.044	.05	237	C.
The year	2,920	3.0	311	3.46	46.77	225,000	
1909–10.							
October	144	5	28.3	.314	.36	1,740	C.
November	10,000	177	1,270	14.1	15.73	75,600	B.
December	1,510	162	629	6.99	8.06	38,700	B.
January	1,140	238	599	6.66	7.68	36,800	B.
February	1,540	290	701	7.79	8.11	38,900	B.
March	1,860	144	459	5.10	5.88	28,200	B.
April	452	110	193	2.14	2.39	11,500	B.
May	110	48	71.5	.794	.92	4,400	B.
June	46	26	34.7	.386	.43	2,060	B.
July	26	6	14.8	.164	.19	910	C.
August	5.5	2.5	4.02	.045	.05	247	C.
September	2.5	1.5	1.82	.020	.02	108	C.
The year	10,000	1.5	330	3.67	49.82	239,000	
1910–11.							
October	30	1.5	14.9	.166	.19	916	C.
November	3,160	6	490	5.44	6.07	29,200	C.
December	1,610	244	542	6.02	6.94	33,300	C.
January	3,640	266	874	9.71	11.20	53,700	C.
February	940	244	587	6.52	6.79	32,600	C.
March	244	75	156	1.73	1.99	9,590	C.
April	452	68	199	2.21	2.47	11,800	C.
May	1,060	90	249	2.77	3.19	15,300	C.
June	131	36	62.9	.699	.78	3,740	C.
July	38	8	18.8	.209	.24	1,160	C.
August	7.0	3.1	4.63	.051	.06	285	C.
September	20	2.9	9.97	.111	.12	593	C.
The year	3,640	1.5	266	2.96	40.04	192,000	

Oreg., for the years ending Sept. 30, 1907–1912
—Continued.

in second-feet.			Run-off.		Accuracy.
m.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
7	13.4	0.149	0.17	824	C.
6	299	3.32	3.70	17,800	B.
82	369	4.10	4.73	22,700	B.
332	1,160	12.9	14.87	71,300	B.
390	890	9.89	10.67	51,200	B.
194	402	4.47	5.15	24,700	B.
102	156	1.73	1.93	9,280	B.
126	313	3.48	4.01	19,200	B.
75	104	1.16	1.29	6,190	B.
36	62.8	.698	.80	3,860	C.
11	21.5	.239	.28	1,320	C.
11	51.0	.567	.63	3,030	C.
6	319	3.54	48.23	231,000	
97	109	1.21	.50	2,380	A.
88	207	2.30	2.65	12,700	A.
56	115	1.28	1.43	6,840	A.
31	42.2	.469	.54	2,590	A.
10	18.4	.204	.24	1,130	A.
4	6.4	.071	.08	381	B.
....	....	....	....	26,000	

RIVER BASIN.

AR TILLAMOOK, OREG.

., R. 9 W., at the highway bridge above the
er, about 7 miles from Tillamook, Tillamook

easured on maps compiled by G. B. Lacey

1914, to September 30, 1915, when station

right bank.
m lower side of highway bridge or by wading.
ably shifts during high floods.
stage recorded during period of record, 9.2
econd-feet); minimum stage recorded, −0.11
92 second-feet).
n unaffected by ice.

near Tillamook, Oreg., during the year ending
. 30, 1915.

y—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	1.52	504
....	3.00	1,400
....	.03	106

Daily discharge, in second-feet, of Wilson River near Tillamook, Oreg., for the year ending Sept. 30, 1915.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		2,270	2,090	1,260	2,810	362	750	200	160	108
2		2,180	2,360	1,190	3,170	328	668	200	151	108
3		2,270	3,440	1,190	2,450	328	590	190	151	103
4		2,090	4,530	1,120	2,360	328	545	180	151	103
5		2,090	4,530	1,120	1,840	295	500	180	151	98
6		2,180	3,930	1,050	1,540	295	460	212	142	98
7		2,270	3,530	990	1,400	265	420	265	142	98
8		2,630	2,900	990	1,260	265	420	362	134	98
9		2,450	2,630	930	1,190	310	380	265	134	98
10		2,360	2,090	930	1,120	362	380	225	134	98
11		3,730	1,610	870	990	380	380	200	134	98
12		5,830	1,470	990	930	400	380	225	134	92
13		6,930	1,400	1,050	930	400	345	280	134	92
14		7,500	1,260	2,090	870	400	310	250	134	92
15		6,160	1,190	2,360	810	400	310	238	127	92
16		5,060	1,120	2,180	722	440	310	238	127	92
17		4,030	1,050	2,000	668	440	280	280	120	92
18	500	3,080	990	2,000	615	500	280	265	120	92
19	511	2,540	930	1,920	568	722	280	250	120	92
20	522	2,090	870	1,840	568	668	250	238	120	92
21	522	1,760	1,050	1,680	568	615	250	250	120	92
22	522	1,400	1,260	1,470	522	668	238	225	114	92
23	522	1,190	1,470	1,190	522	668	225	200	114	92
24	522	990	1,540	930	480	750	238	200	108	92
25	522	810	1,470	750	480	1,120	280	190	108	92
26	2,090	750	1,400	695	440	1,470	280	180	108	103
27	2,180	722	1,400	668	400	1,540	250	180	108	120
28	1,920	668	1,260	668	362	1,400	225	180	108	120
29	1,920	668		722	362	990	212	180	108	108
30	2,360	668		668	362	990	212	180	108	108
31	2,180	1,610		668		870		180	108	

NOTE.—Discharge determined from a rating curve well defined between 100 and 2,000 second-feet.

Monthly discharge of Wilson River, near Tillamook, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 170 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
December 18-31	2,360	500	1,200	7.06	3.68	33,300	B
January	7,500	668	2,610	15.4	17.75	160,000	B.
February	4,530	870	1,960	11.5	11.98	109,000	B.
March	2,360	668	1,230	7.24	8.35	75,600	B.
April	3,170	362	1,040	6.12	6.83	61,900	B.
May	1,540	265	612	3.60	4.15	37,600	A.
June	750	212	355	2.09	2.33	21,100	A.
July	362	180	222	1.31	1.51	13,600	A.
August	160	108	127	.747	.87	7,810	A.
September	120	92	98.5	.579	.65	5,860	B.
The period						526,000	

NORTH FORK OF WILSON RIVER NEAR TILLAMOOK, OREG.

LOCATION.—In the NW. ¼ sec. 24, T. 1 S., R. 9 W., 800 feet above mouth of North Fork, about 8 miles from Tillamook, and about 11 miles from Bay City, Tillamook County.

DRAINAGE AREA.—17 square miles (measured on maps compiled by G. B. Lacey & Co.).

13, to September 30, 1915, **when station was**

y **wading.**
cobblestones; likely to shift.
ge recorded during year, 4.10 feet January 15
nimum stage recorded, 1.30 feet August 11, 12,
3 to 30 (discharge, 14 second-feet).
rded, 5.10 feet September 4, 1913, and January
eet): minimum is that of 1915.
on unaffected by ice.

of Wilson River near Tillamook, Oreg., during ding Sept. 30, 1915.

is- rge.	Date.	Made by—	Gage height.	Dis- charge.
-ft.			*Feet.*	*Sec.-ft.*
37.2	May 29	C. L. Batchelder.......	2.42	266
35	Aug. 24	P. V. Hodges..........	1.36	19.1
45				

Fork of Wilson River near Tillamook, Oreg., for ding Sept. 30, 1915.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
146	132	190	46	132	33	33	18
190	160	740	33	106	33	28	18
208	160	630	33	87	33	28	14
402	132	425	33	78	28	24	14
740	132	315	33	72	28	22	14
630	160	208	33	66	54	22	14
500	160	160	33	62	66	22	14
425	106	132	33	59	119	16	14
380	106	132	36	59	54	16	14
358	106	127	46	62	46	16	14
335	82	119	46	59	43	14	14
278	94	106	46	62	46	14	14
208	146	106	46	49	82	16	14
190	380	94	54	46	62	22	14
175	475	82	46	46	49	20	14
160	425	82	46	43	59	20	14
160	278	82	46	40	62	14	14
132	225	62	72	40	59	14	14
106	146	62	225	40	49	14	14
106	132	62	175	40	46	14	14
146	132	46	106	33	46	14	14
225	146	46	132	33	46	14	14
260	175	40	127	33	40	14	14
225	111	33	154	33	40	19	14
190	106	46	260	46	33	18	14
160	72	46	380	62	33	18	28
160	66	46	485	46	33	18	18
132	62	46	358	40	33	18	14
......	82	46	260	33	33	18	14
......	62	46	225	33	33	18	14
......	62	....	160	....	33	18	14

urve well defined below 600 second-feet.

Monthly discharge of North Fork of Wilson River near Tillamook, Oreg., for the year ending Sept. 30, 1915.

[Drainage area, 17 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	1,040	62	239	14.1	16.26	14,700	B.
November	1,100	72	312	18.4	20.53	18,600	B.
December	402	54	145	8.53	9.83	8,920	B.
January	1,160	54	420	24.7	28.48	25,800	B.
February	740	106	262	15.4	16.04	14,600	B.
March	475	62	155	9.12	10.51	9,530	B.
April	740	33	145	8.53	9.52	8,630	B.
May	485	33	123	7.24	8.35	7,560	B.
June	132	33	54.7	3.22	3.59	3,250	A.
July	119	28	46.9	2.76	3.18	2,880	A.
August	33	14	18.6	1.09	1.26	1,140	A.
September	28	14	14.9	.876	.98	887	A.
The year	1,160	14	161	9.47	128.53	116,000	

MISCELLANEOUS MEASUREMENTS.

The results of measurements of the flow of streams at points other then those at which gaging stations were maintained are presented in the following tables:

Miscellaneous discharge measurements in Lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1915.

Walla Walla River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 19	Walla Walla River	Columbia River	One-fourth mile below junction of North and South forks.		89
Feb. 11	Water supply of Walla Walla, Wash.	Mill Creek	Intake, sec. 12, T. 6 N., R. 37 E., Walla Walla County, Wash.		21.6

Umatilla River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
Sept. 2	Umatilla	Columbia River	Above Pendleton, Oreg., one-eighth mile below intake of Byers millrace, in race.		31
Apr. 19	do	do	Above Furnish reservoir, Oreg., sec. 8, T. 2 N., R. 31 E.		605
May 1	do	do	do		371
July 20	do	do	One-fourth mile below Furnish canal spillway, near Echo, Oreg.		45.5
27	do	do	do		26
Aug. 28	do	do	do		19
Nov. 10	do	do	1,000 feet above Oregon Land & Water Co.'s dam, near Umatilla, Oreg.		94.9
Jan. 8	do	do	One-half mile above U. S. Geological Survey gaging station near Umatilla, Oreg.		79.9
Nov.. 10	Oregon Land & Water Co.'s canal.	Umatilla River	Just below intake near Umatilla, Oreg.	1.09	9.30

n Lower Columbia River basin and Pacific slope
ear ending Sept. 30, 1915—Continued.

Day River basin.

o or om—	Locality.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
er.......	Damsite, 10 miles above Canyon City, Grant County, Oreg.	0.23	8.20
....	Canyon City, Grant County, Oreg.	.03	10.4
....	Allison's ranch, 13 miles above Dale, Oreg.	1.08	74.8
f John	Just below Cable Creek, Oreg.	.65	17.6
....	.....do......................	.75	21.9
....	.....do......................	.51	11.7
....	Near Ukiah, Oreg..........	....	2.25
....	10 miles northwest of Ukiah, Oreg., near elevation 4,500 feet.	....	a1.00
f John	15 miles east of Ukiah, Oreg., near elevation 4,420 feet.	....	1.52
....	10 miles east of Parkers Mill, Oreg., elevation about 4,400 feet.	....	1.34

es River basin.

....	Graft's ranch, above Davis Creek, sec. 3, T. 22 S., R. 8 E., Oreg.	....	478
....	Cline Falls (former gaging station), sec. 14, T. 15 S., R. 12 E., Oreg.	....	317
r......	Graff's ranch, at mouth, sec. 10, T. 22 S., R. 8 E., Oreg.	....	208
....	Mouth, NW. ¼ sec. 6, T. 20 S., R. 11 E., Oreg.	....	222
....	.....do......................	....	182
....	.....do......................	....	188
....	.....do......................	....	176
....	.....do......................	....	155
....	Former gaging station near Tumalo, Oreg., in sec. 3, T. 18 S., R. 10 E.	3.69	135
....	Above Mill Creek, Oreg..	....	41.6
....	Bridge near mouth, Oreg..	....	55.6
....	North of Barnes Butte, Oreg.	....	3.05
....	Near intake at Prineville, Oreg.	....	24.1
....	Allen's ranch, SW. ¼ sec. 11, T. 12 S., R. 9 E., Oreg.	.50	1,100
....	2 miles above gage, NW. ¼ NW. ¼ sec. 29, T. 12 S., R. 9 E., Oreg.	....	16.1
....	SE. ¼ SE. ¼ sec. 17, T. 12 S., R. 9 E., Oreg.	....	2.25
....	SW. ¼ SE. ¼ sec. 17, T. 12 S., R. 9 E., Oreg.	....	3.07
....	NW. ¼ NE. ¼ sec 20., T. 12 S., R. 9 E., Oreg.	....	4.08
....	SW. ¼ NE. ¼ sec. 20, T. 12 S., R. 9 E., Oreg.	....	a3.0
....	One-half mile above mouth, SW. ¼ SW. ¼ sec. 20, T. 12 S., R. 9 E., Oreg.	....	44.5
iver..	He He camp grounds, sec. 19, T. 7 S., R. 11 E., Oreg.	....	18.9
....	.....do......................	....	9.4
....	.....do......................	....	7.25
....	Sec. 15, T. 7 S., R. 11 E., Oreg.	....	42.0
....	.....do......................	....	37.7
....	Discontinued gaging station near Tygh Valley, Oreg.	4.59	39.1
....	.....do......................	4.28	13.2

timated.

Miscellaneous discharge measurements in Lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1915—Continued.

Hood River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 19	Mount Hood ditch...	East Fork of Hood River.	Intake near Mount Hood, Oreg.	....	3.96
July 22	.....do........	.....do........	.....do........	....	18.9
24	.....do........	.....do........	.....do........	....	17.6
Sept. 17	.....do........	.....do........	....	....	12.4

Multnomah Creek basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
July 28	Multnomah Creek...	Columbia River.......	Below Multnomah Falls, Oreg.	....	11.4

Sandy River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
Nov. 8	Zig Zag River.......	Sandy River..........	Rowe, just above Still Creek, Oreg.	0.96	151
Aug. 15	.....do........	.....do........	.....do........	.52	69.6
Sept. 7	.....do........	.....do........	.....do........	.40	70.4
Nov. 7	North Side Boulder Creek.	.....do........	Mouth, near Brightwood, Oreg.	....	18.9
Sept. 7	Salmon River.......	.....do........	Welches, Oreg..........	.20	85.4
Nov. 10	.....do........	.....do........	Former gaging station near Brightwood Oreg.	.48	337

Willamette River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
June 24	Williamette River...	Columbia River.......	Former gaging station at Springfield, Oreg........	1.28	1,750
Sept. 1	.....do........	.....do........	.....do........	....	717
26	Lost Creek..........	McKenzie River......	Near McKenzie Bridge, Oreg. sec. 11. T. 16 S., R. 6 E.	.80	184
25	Horse Creek........	.....do........	Near McKenzie Bridge, Oreg. sec. 23, T. 16 S., R. 5 E.	1.70	245
5	Power canal........	South Santiam River..	Albany, Oreg..........	....	176
9	Mill Creek..........	Willamette River.....	Salem, Oreg., below power canal intake.	....	42.2
9	Power canal........	Mill Creek..........	Salem, Oreg..........	....	116
Aug. 5	Yamhill River.......	Willamette River	Former gaging station near La Fayette, Oreg.	3.30	103

Rogue River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
1913. July 28	Rogue River........	Pacific Ocean.........	Discontinued gaging station, near Prospect, Oreg.	1.27	656
31	.....do........	.....do........	.....do........	1.27	588
1914. Sept. 20	.....do........	.....do........	Above California-Oregon Power Co. canal, near Prospect, Oreg.	....	402
Aug. 19	Mill Creek..........	Rogue River..........	.....do........	....	39.4
Sept. 22	.....do........	.....do........	.....do........	....	47.8
Aug. 5	North Fork of Big Butte Creek.	Big Butte Creek......	Above junction with South Fork, near Butte Falls.	....	3.7
Sept. 17	South Fork of Little Butte Creek.	Little Butte Creek....	Former gaging station near Lake Creek, Oreg.	9.49	14.3
Oct. 21	North Fork of Little Butte Creek.	.....do........	Below Fish Lake, 20 miles east of Lake Creek, Oreg.	.31	31.3
22	.....do........	.....do........	.....do........	.34	27.3
22	.....do........	.....do........	.....do........	.31	34.1
Sept. 18	North Fork of Little Butte Creek.	.....do........	Former gaging station near Lake Creek, Oreg.	.61	37.5
18	First Hanley ditch..	North Fork of Little Butte Creek.	200 feet below intake near Lake Creek, Oreg.	....	15.1

ower Columbia River basin and Pacific slope
ending Sept. 30, 1915—Continued.

basin—Continued.

r	Locality.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
ittle	100 feet below intake		4.1
	Intake		[a] 2.0
k	Intake, near Brownsboro, Oreg.		5.9
	do		11.5
	Former gaging station near Talent, Oreg.	1.18	98.8
	do	.70	20.3
	do	.68	16.8
	do		4.16
	Former gaging station near Buncom, Oreg.	3.07	708
	do	1.28	44.6
	Below Farmer's ditch, near Buncom, Oreg.		2.2
ate	Intake, near Buncom, Oreg.		6.2
	Former gaging station near Buncom, Oreg.	.80	9.14

River basin.

	Roseburg, Douglas County, Oreg.		115
	Trail crossing 1 mile below Bradley Creek, Oreg.[b]		40
	do		31.
	1 mile above Lake Creek, Oreg.[b]		269
	do		270
	1 mile above mouth [a]		21.5
ver.	Outlet of Diamond Lake [a]		19.7
	do		21.8
	Mouth [b]		28.1
	do		23.0
	Bridge, SE. ¼ sec. 24, T. 23 S., R. 10 W.		70.1
	do		66.7
	Half a mile below bridge, sec. 24, T. 23 S., R. 10 W.		12.7
	Mouth, sec. 13, T. 23 S., R. 10 W.		5.2

, on unsurveyed land; see Diamond Lake quadrangle.

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D

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CIFIC SLOPE BASINS

IONS AND PUBLICATIONS
ATER RESOURCES.

DUCTION.

es by the United States Geological
t of measurements of the volume of
e conditions affecting that flow, but
on of such closely allied subjects as
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vater-supply papers, but some have
nographs, professional papers, and

easurements are now published an-
covering an area whose boundaries
eatures as indicated below:

Gulf of Mexico basins.

dson Bay basins.

ree volumes:
ashington and upper Columbia River basin.

asin and Pacific slope basins in Oregon.

IAY BE OBTAINED OR CONSULTED.

r publications of the United States
ta in regard to the water resources
obtained or consulted as indicated

ree of charge by applying to the
ey, Washington, D. C. The edition
owever, small and is soon exhausted.
at nominal cost from the Superin-
ment Printing Office, Washington,
urnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
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Atlanta, Ga., Post Office Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Topeka, Kans., 25 Federal Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Honolulu, Hawaii, 14 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,800 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

A—Annual Report; B—Bulletin; W—Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 2	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.

nited States Geological Survey—Continued.

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ar gaging stations have been made
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years and drainage basins, the num-
ater supply published from 1899 to
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during which the station was main-
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Water-Supply Papers 97, 124, 165,
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rom 1903 to 1915. Results of mis-
blished by drainage basins.

lowing lists the stations are arranged
in stem of any river is determined
rainage area—that is, the headwater
age area is considered the continua-
cal changes in name and lake surface
rom the source to the mouth of the
esented first, and the tributaries in
mouth follow, the streams in each
re those of the next basin below.

e records for Mississippi River are
on page III, and the records for large
e streams around the rim of the lake.

Numbers of water-supply papers containing results of stream measurements, 1899–1915.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope basins (St. John River to York River).	South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi).	Ohio River basin.	St. Lawrence River basin.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope basins in Oregon.
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[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

[b] James River only.

[c] Gallatin River.

[d] Green and Gunnison rivers and Grand River above junction with Gunnison.

[e] Mohave River only.

[f] Kings and Kern rivers and south Pacific slope drainage basins.

[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables of monthly discharge for 1900 in Twenty-second Annual Report, Part IV.

[h] Wissahickon and Schuylkill rivers to James River.

[i] Scioto River.

[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

[k] Tributaries of Mississippi from east.

[l] Lake Ontario and tributaries to St. Lawrence River proper.

[m] Hudson Bay only.

[n] New England rivers only.

[o] Hudson River to Delaware River, inclusive.

[p] Susquehanna River to Yadkin River, inclusive.

[q] Platte and Kansas rivers.

[r] Great Basin in California, except Truckee and Carson river basins.

[s] Below junction with Gila.

[t] Rogue, Umpqua, and Siletz rivers only.

OPE DRAINAGE BASINS.

AL STREAMS.

g into the Pacific Ocean in Oregon
Jmpqua, and Columbia rivers and
rough Puget Sound. The principal
e Kootenai, Clark Fork, Spokane,
lla Walla, Umatilla, John Day, Des-
l Lewis rivers. Nisqually, Puyallup,
rivers flow into Puget Sound. The
holly or in part the States of Idaho,
, Washington, and Wyoming.
g stations and the annotated list of
to the section, these pages contain a
general interest in many sections and
subjects, and also brief references to
other organizations (see pp. XXXI–

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1903–1905.
–1910.
, 1908–1910; 1912–
, Mont., 1911–12; 1914–
h near Elliston, Mont., 1910–
., 1910–1912.
Mont., 1898–1905.
Mont., 1898–1900.
ead of Bitterroot River), near Darby, Mont.,

e, Mont., 1902–1907.
Mont., 1898–1901; 1903–4.
er near Darby, Mont., 1910–
., 1910–
Mont., 1910–
Falls, Mont., 1910–
near Kalispell, Mont., 1910–1912.
ch, near Kalispell, Mont., 1910–1912.
h, near Holt, Mont., 1910–1912.
ver) near Holt, Mont., 1900.
, 1908–
nt., 1907–
r at Belton, Mont., 1910–
at Lake McDonald, Mont., 1912–1914.
ver near Columbia Falls, Mont., 1910–
Mont., 1910–11.
pell, Mont., 1906–7.
alispell, Mont., 1906.
Marion, Mont., 1910–
Hubbart, Mont., 1909–

Geographic Board rendered Oct. 3, 1917.

- Columbia River tributaries—Continued.
    - Clark Fork tributaries—Continued.
        - Flathead River tributaries—Continued.
            - Little Bitterroot River near Dayton, Mont., 1908–9.
            - Crow Creek near Ronan, Mont., 1906–
            - Crow Creek at Lozeau's ranch, near Ronan, Mont., 1911–
                - Mud Creek near Ronan, Mont., 1908–1910.
            - Mission Creek near St. Ignatius, Mont., 1906–
                - Dry Creek near St. Ignatius, Mont., 1908–
                - Post Creek at Fitzpatrick's ranch, near Ronan, Mont., 1906–1911.
                - Post Creek at Deschamp's ranch, near Ronan, Mont., 1911.
                - Post Creek near St. Ignatius, Mont., 1911–
            - Jocko River, South Fork (head of Jocko River), near Jocko, Mont., 1912–
            - Jocko River near Jocko, Mont., 1908–
            - Jocko River at Ravalli, Mont., 1906–1911.
                - Middle Fork of Jocko River near Jocko, Mont., 1912–
                - North Fork of Jocko River near Jocko, Mont., 1912–
                    - Falls Creek near Jocko, Mont., 1912–
                - Big Knife Creek near Jocko, Mont., 1908–
                - Agency Creek near Jocko, Mont., 1908–
                    - Blodgett Creek near Jocko, Mont., 1909–10.
                - Finley Creek near Jocko, Mont., 1908–
                    - East Finley Creek near Jocko, Mont., 1908–
                        - Indian ditch near Jocko, Mont., 1908–1911; 1912–
                - Valley Creek near Ravalli, Mont., 1908–1911.
            - Revais Creek near Dixon, Mont., 1911–
        - Thompson River near Thompson Falls, Mont., 1911–
        - Prospect Creek near Thompson Falls, Mont., 1911–
        - Priest River at outlet of Priest Lake, at Coolin, Idaho, 1911–
        - Priest River at Falk's ranch, near Priest River, Idaho, 1911–12.
        - Priest River near Priest River, Idaho, 1903–1905; 1910–11.
        - Sullivan Lake near Metaline Falls, Wash., 1912–
        - Sullivan Creek near Metaline Falls, Wash., 1912–
    - Kettle River at Curlew, Wash., 1911–12.
    - Kettle River at Boyds, Wash., 1913–1915.
    - Hall Creek near Inchelium, Wash., 1912–
    - Stranger Creek at Inchelium, Wash., 1914–
    - Cœur d'Alene River, North Fork (head of Cœur d'Alene River and through Cœur d'Alene Lake of Spokane River) at Prichard, Idaho, 1911–1914.
    - Cœur d'Alene River, North Fork, at Enaville, Idaho, 1911–1913.
    - Cœur d'Alene River near Cataldo, Idaho, 1911–12.
    - Cœur d'Alene Lake at Cœur d'Alene, Idaho, 1903–
    - Spokane River at Post Falls, Idaho, 1913–
    - Spokane River at Trent, Wash., 1911–1913.
    - Spokane River at Washington Water Power Co.'s dam, at Spokane, Wash., 1891–1896.
    - Spokane River at Spokane, Wash., 1896–
    - Spokane River near Long Lake, Wash., 1912–
        - Little North Fork of Cœur d'Alene River near Enaville, Idaho, 1911–12.
        - St. Joe River at Avery, Idaho, 1911–
        - St. Joe River near Calder, Idaho, 1911–12.
            - St. Maries River at Lotus, Idaho, 1911–12.
        - Spokane Valley Land & Water Co.'s canal near Post Falls, Idaho, 1911–

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nued.
d near Tekoa, Wash., 1904–5.
k near Spokane, Wash., 1904–5.
okane, Wash., 1903–1905; 1911–1913.
911–
sh., 1911–
sh., 1911–
ville, Wash., 1911–
oomis, Wash., 1903–1905.
, Wash., 1903–1907.
y, Wash., 1910–
, Wash., 1903–1912.
., 1912.
1903–
Wash., 1912–13.
, 1911–1913.
River) at Stehekin, Wash., 1910–
1897–1899.
05; 1910–
903–
Vash., 1910–1913.
10–
rth, Wash., 1910–
hmere), Wash., 1904–
Wash., 1897.
n, Wash., 1911–12; 1914.
sh., 1911.
worth, Wash., 1911–12; 1913–14.
aukum, Wash., 1911.
th, Wash., 1911–14.
Wash., 1911–12.
worth, Wash., 1911–12.
Dryden, Wash. (irrigation seasons only), 1912–
h., 1904.
0; 1911; 1912.
1909.
ke), Wash., 1909–1914.
1909–1912.
Vash., 1909–1911.
er) near Martin, Wash., 1906–
., 1903–
1904; 1910–1915.
h., 1906–
sh., 1906–
r Yakima,[1] Wash., 1897; 1904; 1911; 1912.
ash., 1894–1909; 1911–1914.
sh., 1908–
, 1904–1906; 1911–12.
h., 1904–1906; 1913–
1895–1915.

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nty, Wash.; not North Yakima. Decision of U. S. Geo-

Columbia River tributaries—Continued.
- Yakima River near Richland, Wash., 1906–1911.
    - Cabin Creek near Easton, Wash., 1909–1911.
    - Kachess Lake (on Kachess River) near Easton, Wash., 1905–
    - Kachess River near Easton, Wash., 1903–
    - Big Creek near Cle Elum, Wash., 1909.
    - Cle Elum River, North Fork (head of Cle Elum River), at Galena, Wash., 1907; 1911.
    - Cle Elum Lake near Roslyn, Wash., 1906–
    - Cle Elum River near Roslyn, Wash., 1903–
    - Teanaway River below Forks, near Cle Elum, Wash., 1911–12.
    - Teanaway River near Cle Elum, Wash., 1909–1911; 1912–1914.
    - Swauk Creek near Cle Elum, Wash., 1909–1912.
    - Cascade canal near Ellensburg (Thorp), Wash., 1905–6; 1909–1911.
    - West Kittitas canal near Thorp, Wash., 1904–1906; 1909–1911.
    - Ellensburg Water Co.'s canal near Ellensburg, Wash., 1904–5; 1909–1911.
    - Taneum Creek near Thorp, Wash., 1909–1912.
    - Manastash Creek near Ellensburg, Wash., 1909–1914.
    - Wilson Creek near Thrall, Wash., 1911.
    - Selah Moxee canal near Selah, Wash., 1904–5; 1909–1911.
    - Wenas Creek near Selah, Wash., 1909–1912.
    - Naches River at Anderson's ranch, near Nile, Wash., 1909–1914.
    - Naches River at Oak Flat, near Nile, Wash., 1904–
    - Naches River below Tieton River, near Naches, Wash., 1905; 1909–1912.
    - Naches River near Yakima,[1] Wash., 1893–1897; 1898–1912.
        - Bumping Lake (on Bumping River) near Nile, Wash., 1909; 1910–
        - Bumping River at Bumping Lake, near Nile, Wash., 1906; 1909–
            - American River near Nile, Wash., 1909; 1910; 1911; 1913; 1914; 1915.
        - Selah Valley canal near Naches, Wash., 1904–1906; 1909–1913.
        - Tieton River, North Fork, below Clear Creek, near Naches, Wash., 1914–
        - Tieton River at McAllister Meadows, near Naches, Wash., 1908–1914.
        - Tieton River at headworks of Tieton canal, near Naches, Wash., 1906–
        - Tieton River at Cobb's ranch, near Naches, Wash., 1902–1913.
            - Tieton canal near Naches, Wash., 1910–
        - Wapatox canal near Naches, Wash., 1904–5; 1909–11.
        - Naches Canal Co.'s (Gleed) canal near Naches, Wash., 1904–1906; 1909–1911.
        - Yakima Valley (Congdon) canal near Naches, Wash., 1904–1906; 1909–1911.
        - Naches–Cowiche canal near Naches, Wash., 1904–5; 1909–1911.
        - Yakima[1] power canal near Yakima,[1] Wash., 1904–1906; 1909–10.
            - Schanno canal near Yakima, Wash., 1904–5; 1909–1911.
            - Yakima[1] power waste at Yakima, Wash., 1909–1912.
            - Yakima[1] mill waste at Yakima, Wash., 1909–1912.
                - Naches Avenue Union canal at Yakima, Wash., 1904–1906, 1909–1911.
        - Old Union canal near Yakima, Wash., 1904–1906; 1909–1911.
        - Moxee Co.'s canal near Yakima, Wash., 1904–1906; 1909–1911.
        - Fowler canal near Yakima, Wash., 1904–1906; 1909–1911.
    - Ahtanum Creek, North Fork (head of Ahtanum Creek), near Tampico, Wash., 1907–
    - Ahtanum Creek at The Narrows, near Tampico, Wash., 1908–1913.

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[1] Decision of U. S. Geographic Board; formerly called North Yakima.

ed.
,[1] Wash., 1904; 1907–1912.
eek at Conrad ranch, near Tampico, Wash.,

ek near Tampico, Wash., 1907–1914.
ker (Union Gap), Wash., 1904–
ker (Wapato), Wash., 1904–
Vash., 1904–
coe, Wash., 1909–
an (Wapato), Wash., 1909–1912.
ge, near Toppenish, Wash., 1894–1896.
, Wash., 1908–9.
h., 1909–1912.
coe, Wash., 1909–
, Wash., 1912–
sh., 1908–1913.
Creek, near Toppenish, Wash., 1913–
1905.
894–1896.
1904–1906; 1908–1911.
(Kennewick), Wash., 1904–5; 1910–11.
, Wash., 1905; 1910–11.
ellowstone National Park, 1913–
ran, Wyo., 1909–10 (fragmentary); 1911–
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889–1890; 1892–1894.
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1910–

Minidoka, Idaho, 1910–
ear Minidoka, Idaho, 1895–1899; 1901–1910
ner, Idaho, 1911–

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1912–
09–
12; 1913–

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907–
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laho, 1910–1915.
02–1909.
ll River, Idaho, 1890–91.

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ndered Jan. 2, 1918; formerly called Yakima City.
rmerly called South Fork of Snake River.
merly called North Fork of Snake River.

- Columbia River tributaries—Continued.
    - Snake River tributaries—Continued.
        - Henrys Fork near Rexburg, Idaho, 1909–
            - Warm River at Warm River, Idaho, 1912–1915.
                - Robinson Creek at Warm River, Idaho, 1912–1915.
            - Fall River near Marysville, Idaho, 1902–3.
            - Fall River at Fremont, Idaho, 1904–1909 (replace Marysville station).
            - Fall River at Canyon, Idaho, 1890–1901.
            - Teton River near St. Anthony, Idaho, 1903–1909.
            - Teton River at Chase's ranch, Idaho, 1890–1893.
        - Idaho (Government) canal near Shelley, Idaho, 1912–
        - Willow Creek near Prospect, Idaho, 1903–4.
        - Blackfoot River above the reservoir, near Henry, Idaho, 1914–
        - Blackfoot-Marsh reservoir near Henry, Idaho, 1912–
        - Blackfoot River below reservoir, near Henry [near Rossfork], Idaho, 1908–
        - Blackfoot River near Shelley, Idaho, 1909–
        - Blackfoot River near Presto, Idaho, 1903–1909.
        - Blackfoot River near Blackfoot, Idaho, (fragmentary), 1913; 1914; 1915–
            - Little Blackfoot River at Henry, Idaho, 1914–
                - Meadow Creek near Henry, Idaho, 1914–
        - Idaho (Government) canal near Firth, Idaho, 1914–
            - Fort Hall upper canal near Blackfoot, Idaho, 1912–
            - Fort Hall lower canal near Blackfoot, Idaho, 1912–
        - Big Lost River near Chilly, Idaho, 1904–1906; 1907–1915.
        - Big Lost River near Mackay, Idaho, 1903–1906; 1912–1915.
            - Thousand Springs Creek near Chilly, Idaho, 1912–13; 1914.
            - Sharp ditch near Mackay, Idaho, 1912–1914.
            - Streeter ditch near Mackay, Idaho, 1913–1914.
            - Cedar Creek above forks, near Mackay, Idaho, 1911–1913.
            - Cedar Creek below forks, near Mackay, Idaho, 1911–1913.
            - Antelope Creek near Darlington, Idaho, 1913–
            - Little Lost River near Clyde, Idaho, 1910–1913.
            - Birch Creek near Kaufman, Idaho, 1910–1912.
            - Camas Creek near Hamer, Idaho, 1912–13.
        - Portneuf River above reservoir, near Chesterfield, Idaho, 1912–1914.
        - Portneuf diversion channel near Chesterfield, Idaho, 1914.
        - Portneuf River below reservoir, near Chesterfield, Idaho, 1912–1915.
        - Portneuf River near Pebble, Idaho, 1910–1913.
        - Portneuf River at Topaz, Idaho, 1913–1915.
        - Portneuf River near McCammon, Idaho, 1896.
        - Portneuf River at Pocatello, Idaho, 1897–1899; 1911–
            - Topons Creek near Chesterfield, Idaho, 1912–1915.
            - Pebble Creek near Pebble, Idaho, 1911–1914.
            - Birch Creek near Downey, Idaho, 1911–1914.
        - Raft River near Bridge, Idaho, 1909–1915.
            - Clear Creek near Naf, Idaho, 1910–11; 1912.
            - Cassia Creek near Conant, Idaho, 1909–1912.
        - North Side Minidoka canal near Minidoka, Idaho, 1909–
        - South Side Minidoka canal near Minidoka, Idaho, 1909–
        - Goose Creek above Trapper Creek, near Oakley, Idaho, 1911–
        - Goose Creek near Oakley, Idaho, 1909–1911.
            - Trapper Creek near Oakley, Idaho, 1911–
            - Birch Creek near Oakley, Idaho, 1912–13; 1914–

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Milner, Idaho, 1909–
Milner, Idaho, 1909–
kley, Idaho, 1909–
Idaho, 1912.
Idaho, 1909–1913.
Creek, Idaho, 1910; 1912.
er Vineyard ditch, near Contact, Nev., 1914.
er Vineyard ditch, near Contact, Nev., 1914.
Line canal, near San Jacinto, Nev., 1914.
acinto, Nev., 1909–
Falls, Idaho, 1909–10.
r Contact, Nev., 1914.
r Contact, Nev., 1914.
d ranch, near Contact, Nev., 1914.
d ranch, near Contact, Nev., 1914.
, Nev., 1914.
tact, Nev., 1914.
, Nev., 1914.
Jacinto, Nev., 1914.
Jacinto, Nev., 1914.
nto, Nev., 1914.
ar San Jacinto, Nev., 1914.
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r San Jacinto, Nev., 1914.
acinto, Nev., 1914–15.
San Jacinto, Nev., 1914.
th, Idaho, 1909–
reek, Idaho, 1912–1914.
Idaho, 1904–5.
aho, 1889; 1915–
laho, 1915–
, Idaho, 1911–
dam, near Richfield, Idaho, 1911–
Gooding canal, near Shoshone, Idaho, 1911;

e, Idaho, 1905–6; 1908–1913.
laho, 1896–1899.
aho, 1899.
Idaho, 1912–
rey, Idaho, 1904–5.
ichfield, Idaho, 1911–
nis [Gooding], Idaho, 1896–1899.
Idaho, 1911–1914.
ll, Idaho, 1913.
Ferry, Idaho, 1909–1913.
y, Idaho, 1909–1913.
nett, Idaho, 1909–1913.
Idaho, 1909–1913.
Nev., 1913–
daho, 1910–1912.
g, Idaho, 1909–1915.

- Columbia River tributaries—Continued.
  - Snake River tributaries—Continued.
    - Bruneau River near Grandview, Idaho, 1895–1903; 1909–
      - Sheep Creek near Tindall, Idaho, 1910–1913.
      - Marys Creek near Owyhee, Nev., 1913–1915.
      - Marys Creek at Tindall, Idaho, 1910–1913.
      - Louse Creek near Wickahoney, Idaho, 1911.
      - East Fork of Bruneau River near Three Creek, Idaho, 1912–1914.
      - East Fork of Bruneau River near Hot Spring, Idaho, 1910–1915.
        - Three Creek near Three Creek, Idaho, 1912–1914.
          - Cherry Creek near Three Creek, Idaho, 1912–1914.
          - Deadwood Creek near Three Creek, Idaho, 1912–1914.
      - Buckaroo ditch at Hot Spring, Idaho, 1912–1914.
      - Grandview canal near Grandview, Idaho, 1912–1915.
    - Castle Creek near Castle Creek, Idaho, 1910–11.
    - Sucker Creek near Homedale, Idaho, 1903–1910.
    - Owyhee River at Mountain City, Nev., 1913.
    - Owyhee River near Owyhee, Nev., 1913–
    - Owyhee River at Owyhee, Oreg., 1890–1896; 1903–
      - South Fork of Owyhee River near Tuscarora, Nev., 1913.
      - Jack Creek near Tuscarora, Nev., 1913–
      - Jordan Creek near Jordan Valley, Oreg., 1911–
        - Cow Creek at Narrows, near Jordan Valley, Oreg., 1914.
        - Cow Creek at mouth, near Jordan Valley, Oreg.. 1914.
      - Owyhee canal near Owyhee, Oreg., 1904–5; 1911–
    - Boise River near Twin Springs, Idaho, 1911–
    - Boise River at Dowling's ranch, near Arrowrock, Idaho, 1911–
    - Boise River near Highland, Idaho (replaces the Boise station), 1905–1915
    - Boise River near Boise, Idaho, 1894–1904.
    - Boise River at Caldwell, Idaho, 1895–96.
      - Cottonwood Creek near Arrowrock, Idaho, 1914–
      - South Fork of Boise River near Lenox, Idaho, 1911–
      - Little Camas Creek, near Little Camas Store, Idaho, 1896.
      - Moore Creek near Arrowrock, Idaho, 1915–
        - Grimes Creek near Centerville, Idaho, 1910.
      - Dry Creek:
        - Spring Creek near Boise, Idaho, 1911–12.
    - Wilson ditch near Ontario, Oreg., 1904–5.
    - Malheur River near Drewsey, Oreg., 1914.
    - Malheur River at Warmsprings reservoir site, near Riverside, Oreg., 1914–
    - Malheur River above South Fork, at Riverside, Oreg., 1906–7; 1908–1910.
    - Malheur River at Riverside, Oreg., 1909–1915.
    - Malheur River near Namorf, Oreg., 1913–
    - Malheur River near Harper ranch, near Westfall, Oreg., 1903–1905.
    - Malheur River near Little Valley, Oreg., 1914.
    - Malheur River at McLaughlin bridge, near Vale, Oreg., 1904–1906.
    - Malheur River at Vale, Oreg., 1890–91; 1895–96; 1903–1914.
    - Malheur River at Halliday bridge, near Ontario, Oreg., 1904–5.
    - Malheur River near Ontario, Oreg., 1903–4.
      - South Fork of Malheur River at Riverside, Oreg., 1910–1913; 1913–1915.
      - North Fork of Malheur River at Scotts ranch, near Beulah, Oreg., 1914.
      - North Fork of Malheur River at Foley's ranch, near Beulah, Oreg., 1909–1912; 1913–14.
      - Vines ditch near Little Valley, Oreg., 1904–5; 1914.

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ntinued.
bove Vale, Oreg., 1904–5.
Vale, Oreg., 1904–5.
Oreg., 1904–5.
h above Vale, Oreg., 1904–5.
Vale, Oreg., 1904–5.
, Oreg., 1911; 1912–13.
gs, near Vale, Oreg., 1903–4; 1905–1907; 1911–
., 1904–5.
Oreg., 1904–5.
r, Oreg., 1904–6; 1910–11; 1912–
Oreg., 1910–
., 1904–1906.
n, Oreg., 1912–1914.
an, Oreg., 1912–13.
Oreg., 1904–5.
Bend, Idaho, 1906–
no, 1895–1897.
er at Lardo, Idaho, 1908–
er at Van Wyck, Idaho, 1912–
River near McCall, Idaho, 1909–1914.
oe Bend, Idaho, 1911–12.
seshoe Bend, Idaho, 1911–12.
no, 1890–91; 1894–1904; 1910–1915.
near Fruitvale, Idaho, 1910–1913.
rack, Idaho, 1910–1914.
er at Middle Fork, Idaho, 1910–1913.
ale, Idaho, 1913.
ar Midvale, Idaho, 1913.
vale, Idaho, 1913.
, Idaho, 1910–
daho, 1911–1913.
n) near Weiser, Idaho, 1911–12.
n) near Weiser, Idaho, 1911–1913.
of Burnt River), near Audrey, Oreg., 1915–
reg., 1915–
Oreg., 1915–
r near Audrey, Oreg., 1915.
near Unity, Oreg., 1915–
nity, Oreg., 1915.
, Oreg., 1915.
g., 1903–1914.
1913; 1914.
er, Oreg., 1909–1912; 1913–
Oreg., 1913; 1914.
er, Oreg., 1913; 1914.
g., 1913; 1914.
aker, Oreg., 1913.
ker, Oreg., 1913; 1914.
h near Baker, Oreg., 1914.
near Baker, Oreg., 1913; 1914.
ker, Oreg., 1913; 1914.

- Columbia River tributaries—Continued.
  - Snake River tributaries—Continued.
    - Powder River tributaries—Continued.
      - Willow Creek near Haines, Oreg., 1913.
      - North Powder River at Gardner's ranch, near North Powder, Oreg., 1912.
      - North Powder River at North Powder, Oreg., 1912; 1913; 1914.
        - Anthony Creek near North Powder, Oreg., 1912.
      - Wolf Creek near North Powder, Oreg., 1913; 1914.
      - Big Creek near Medical Springs, Oreg., 1913; 1914.
      - Goose Creek near Keating, Oreg., 1913; 1914.
      - Eagle Creek above West Fork, near Baker, Oreg., 1911.
      - Eagle Creek near Baker, Oreg., 1909–10.
      - Eagle Creek near New Bridge, Oreg., 1910–11; 1914.
        - West Fork of Eagle Creek near Baker, Oreg., 1911.
      - Daly Creek near Richland, Oreg., 1913.
    - Salmon River near Pierson, Idaho, 1911–1913
    - Salmon River at Salmon, Idaho, 1912–
    - Salmon River at Whitebird, Idaho, 1910–
      - Lake Creek near Stanley, Idaho, 1910–1913.
      - Valley Creek near Stanley, Idaho, 1910–1913.
      - Pahsimeroi River near Goldburg, Idaho, 1910–1913.
      - Pahsimeroi River below the sinks, near Goldburg, Idaho, 1913.
        - Goldburg Creek near Goldburg, Idaho, 1910; 1913.
        - Big Creek near Patterson, Idaho, 1910–1913.
      - Lemhi River:
        - Timber Creek near Leadore, Idaho, 1912.
          - West Fork of Timber Creek near Leadore, Idaho, 1912.
        - Eightmile Creek near Leadore, Idaho, 1912.
      - North Fork of Salmon River near North Fork, Idaho, 1912.
    - Grande Ronde River at Hilgard, Oreg., 1903–1915.
    - Grande Ronde River at Elgin, Oreg., 1903–1912.
    - Grande Ronde River at Zindel, Wash., 1904–1912.
      - Catherine Creek near Union, Oreg., 1906–7; 1911–12; 1915.
        - Little Creek near Union, Oreg., 1915.
      - Mill Creek near Summerville, Oreg., 1914–15.
      - Wallowa Lake (on Wallowa River) near Joseph, Oreg., 1905–6; 1912–1914; 1915.
      - Wallowa River at Joseph, Oreg., 1903-1914; 1915.
      - Wallowa River near Wallowa, Oreg., 1903–1907.
      - Wallowa River at Minam (near Elgin), Oreg., 1903–1914.
        - Silver Lake ditch near Joseph, Oreg., 1905; 1915.
        - Farmers' and Citizens' ditch near Joseph, Oreg., 1905; 1915.
        - Granger ditch at Joseph, Oreg., 1905; 1915.
        - Big Bend ditch at Joseph, Oreg., 1905; 1915.
        - Hurricane Creek near Joseph, Oreg., 1915.
        - Lostine River near Lostine, Oreg., 1912–1914; 1915.
        - Company ditch near Wallowa, Oreg., 1905.
        - Bear Creek near Wallowa, Oreg., 1915.
        - Minam River at Minam, Oreg., 1912–1914.
    - Asotin Creek near Shelmans ranch, near Asotin, Wash., 1904-1906.
    - Asotin Creek near Asotin, Wash., 1904–5; 1910; 1911.
    - Selway River (head of Clearwater River), near Lowell, Idaho, 1911-12.
    - Clearwater River at Kamiah, Idaho, 1910–

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d.
Idaho, 1910–1913.
Idaho, 1910–1912.
River near Grangeville, Idaho, 1910–
River at Kooskia, Idaho, 1910–1912.
aho, 1911–12.
, Wash., 1913–1915.
, Wash., 1914–
daho, 1914–
sh., 1904–5.
ash., 1915–
., 1897–
. John), Wash., 1903–1905; 1914–
Wash., 1904–5.
ash., 1904.
eg., 1903–1908.
ash., 1897–1899.
ver near Milton, Oreg., 1906; 1907–
er near Milton, Oreg. (lower station), 1903–1906.
ash., 1913–
896–1911.
., 1891–2; 1903–1905.
rvoir, near Yoakum, Oreg., 1915–
1903–
g., 1903–
near Gibbon, Oreg., 1912–
Oreg., 1903–4.
on, Oreg., 1905.
lin, Oreg., 1905–6.
, Oreg., 1905.
reg., 1905–6.
Oreg., 1905–6.
Oreg., 1905–6.
05–6.
's (Hinkle) ditch at Echo, Oreg., 1905–6.
1905–6.
1905–6.
o.'s (Hermiston) ditch near Hermiston, Oreg.,

Oreg., 1905–6.
tch at Umatilla, Oreg., 1905–6.
reg., 1905–6.
., 1905–6.
h., 1911–13.
, Wash., 1911–13.
eg., 1908–1914.
1914–15
g., 1904–
at Dayville, Oreg., 1908–1914.
e, Oreg., 1910–1914.
ek, near Ukiah, Oreg., 1914–
ek, near Ukiah, Oreg., 1914.
Oreg., 1914–
eg., 1905; 1911.

Columbia River tributaries—Continued.
- Deschutes River at Crane Prairie, near Lapine, Oreg., 1914–
- Deschutes River at Forest Service bridge, near Lapine, Oreg., 1910; 1912; 1913–
- Deschutes River near Lava, Oreg., 1905–1907; 1909–1911; 1912; 1913–
- Deschutes River at West's ranch, near Lava, Oreg., 1906–1909; 1914.
- Deschutes River at Benham Falls, Oreg., 1909–1914.
- Deschutes River at Lava Island, Oreg., 1915–
- Deschutes River at Bend, Oreg., 1904–
- Deschutes River below Bend, Oreg., 1914–
- Deschutes River at Tumalo [Laidlaw], Oreg., 1909–1912; 1914–
- Deschutes River near Cline Falls, Oreg., 1910–11; 1912–13.
- Deschutes River near Mecca, Oreg., 1911–
- Deschutes River at Sherar, Oreg., 1912–1914.
- Deschutes River at Moro, Oreg., 1897–1899.
- Deschutes River at Moody (Biggs), Oreg., 1906–
  - Odell Creek near Crescent, Oreg., 1911; 1912; 1913; 1914.
  - Fall River near Lapine, Oreg., 1912.
  - East Fork at Crescent, Oreg., 1904–1908; 1910–11; 1913–14.
  - East Fork at Morson's intake, near Lapine, Oreg., 1914–
  - East Fork near Lapine, Oreg., 1910–1913.
  - East Fork at Allen's ranch, near Lava, Oreg., 1905–1912; 1913–1915.
    - Crescent Creek at outlet of Crescent Lake, near Crescent, Oreg., 1911; 1912–
    - Crescent Creek below Cold Creek, near Crescent, Oreg., 1912–13.
    - Crescent Creek near Crescent, Oreg., 1912–13; 1914.
    - Big Marsh Creek near Crescent, Oreg., 1912–1914.
  - Arnold canal near Bend, Oreg., 1914–
  - Central Oregon canal near Bend, Oreg., 1905–
  - Pilot Butte canal near Bend, Oreg., 1905–
  - North canal near Bend, Oreg., 1913–
  - Swalley canal near Bend, Oreg., 1913–
  - Tumalo Creek near Tumalo [Laidlaw], Oreg., 1906–1914.
  - Tumalo Creek near Bend, Oreg., 1906–
    - Lewis Creek near Tumalo [Laidlaw], Oreg., 1908–9.
    - Wimer canal near Tumalo [Laidlaw], Oreg., 1906–1914.
    - Columbia Southern canal near Tumalo [Laidlaw], Oreg., 1906–1914.
    - Tumalo feed canal near Bend, Oreg., 1914–
  - Squaw Creek near Sisters, Oreg., 1906–
    - McAllister's ditch near Sisters, Oreg., 1909–1913.
  - Crooked River near Post, Oreg., 1908–1911.
  - Crooked River at Hoffman's ranch, near Prineville, Oreg., 1913–14.
  - Crooked River near Prineville, Oreg., 1908–1912.
  - Crooked River at Prineville, Oreg., 1914.
    - Prineville flour mill tailrace at Prineville, Oreg., 1914.
    - Ochoco Creek near Howard, Oreg., 1910–11.
    - Ochoco Creek at Elliot's ranch, near Prineville, Oreg., 1908–1910; 1914–
    - Ochoco Creek at Prineville, Oreg., 1912; 1913–1915
      - Tableland ditch near Prineville, Oreg., 1915–
      - Elliot ditch near Prineville, Oreg., 1908–1910; 1914–
    - McKay Creek near Prineville, Oreg., 1915–
  - Metolius River at Allingham ranger station, near Sisters, Oreg., 1910–1913 1915.
  - Metolius River at Hubbard's ranch, near Grandview, Oreg., 1910–1913.

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near Sisters, Oreg., 1908–1912.
eg., 1911–1913; 1915–
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dview, Oreg., 1911–1913.
reg., 1911–
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Oreg., 1915.
spring, Oreg., 1911–
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Oreg., 1911–
Oreg., 1911–1913.
ear Glenwood, Wash., 1910.
reek, Wash., 1905.
reek, Wash., 1905; 1907–8.
Vash., 1907–1908.
1., 1909–
sh., 1914.
ear Klickitat, Wash., 1908–9.
, Wash., 1909–1912.
Lyle, Wash., 1907–1910.

ar Glenwood, Wash., 1910.
of Cougar Creek, near Wright, Wash., 1905;

endale, Wash., 1910–1912.

907; 1910–1912; 1913.
1897–1899; 1913–
River, Oreg., 1913–
ntake, near Mount Hood, Oreg., 1915–
ount Hood, Oreg., 1913–14.
canal near Mount Hood, Oreg., 1913–
ee, Oreg., 1913–
e near Hood River, Oreg., 1914.
ear Trout Lake, Wash., 1912–
1., 1909–
near Underwood, Wash., 1912–13.
9–1911.
ava Creek, near Cook, Wash., 1903–1906.[1]
ks, Wash., 1909.
912–13.
Brightwood, Oreg., 1910–1914.
ear Brightwood, Oreg., 1907–1911.
1–
near Bull Run, Oreg., 1910–1912.

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vey Water-Supply Paper 272, pp. 428–429.

Columbia River tributaries—Continued.

- Sandy River below Bull Run River, near Bull Run, Oreg., 1910–1914.
  - Clear Fork of Sandy River near Welches, Oreg., 1913; 1914–15.
  - Lost Creek near Brightwood, Oreg., 1913–
  - Still Creek near Rowe, Oreg., 1910–1912.
  - Salmon River near Rowe, Oreg., 1910–1912.
  - Salmon River at Welches, Oreg., 1913–14.
  - Salmon River at Fish Hatchery, near Brightwood, Oreg., 1912–13.
  - Bull Run River near Bull Run, Oreg., 1895–
    - Little Sandy River near Marmot, Oreg., 1913–
    - Little Sandy River near Bull Run, Oreg., 1911–1913.
      - Little Sandy flume near Bull Run, Oreg., 1912–13.
- Willamette River, Middle Fork (head of Willamette River), above Salt Creek, near Oakridge, Oreg., 1913–14.
- Willamette River, Middle Fork, below North Fork, near Oakridge, Oreg., 1911–12.
- Willamette River, Middle Fork, at Jasper, Oreg., 1905–1912; 1913–
- Willamette River at Springfield, Oreg., 1911–1913.
- Willamette River at Albany, Oreg., 1878–1880; 1892–
- Willamette River at Salem, Oreg., 1909–
- Willamette River at Oregon City, Oreg., 1909–1912.
  - Salt Creek near Oakridge, Oreg., 1913–14.
  - Salmon Creek near Oakridge, Oreg., 1913–
  - North Fork of Middle Fork of Willamette River near Oakridge (Hazeldell), Oreg., 1909–1912; 1913–
  - Fall Creek near Fall Creek, Oreg., 1911.
  - Coast Fork of Willamette River near Goshen, Oreg., 1905–1912.
    - Row River near Disston, Oreg., 1910–1913.
  - McKenzie River at Clear Lake, Oreg., 1912–1915.
  - McKenzie River at McKenzie Bridge, Oreg., 1910–
  - McKenzie River at Martins Rapids, Oreg., 1910–11.
  - McKenzie River near Springfield, Oreg., 1905–1915.
    - Eugene power canal near Walterville, Oreg., 1912–1915.
  - North Santiam River near Hoover, Oreg., 1910–13.
  - North Santiam River at Detroit, Oreg., 1907–1909.
  - North Santiam River at Niagara, Oreg., 1908–
  - North Santiam River at Mehama, Oreg., 1905–1907; 1910–1914.
  - Santiam River at Jefferson, Oreg., 1905–6; 1908–
    - Marion Fork of Santiam River at Marion Lake, near Hoover, Oreg., 1907; 1909–1912.
      - Puzzle Creek near Detroit (Hoover), Oreg., 1907; 1909.
        - North Fork of Puzzle Creek near Hoover, Oreg., 1909–1912.
        - South Fork of Puzzle Creek near Hoover, Oreg., 1909–1912.
    - Pamelia Creek near Detroit, Oreg., 1907; 1909; 1913.
    - Whitewater Creek near Detroit, Oreg., 1907; 1913.
    - Breitenbush Creek near Detroit, Oreg., 1910–1913.
    - South Santiam River near Cascadia, Oreg., 1910–1913.
    - South Santiam River near Foster, Oreg., 1911.
    - South Santiam River at Waterloo, Oreg., 1905–1907; 1910–11.
      - Middle Santiam River near Foster, Oreg., 1911.
  - Luckiamute River near Suver, Oreg., 1905–1911.
  - Yamhill River, South Fork (head of Yamhill River), at Sheridan, Oreg., 1906–1913.
  - Yamhill River at La Fayette, Oreg., 1908–1914.

inued.
g., 1905–1909–
, Oreg., 1909–
reg., 1908–1911.
Oreg. (replaced by Estacada station), 1905–

, Oreg., 1911–12.
as River at Timothy Meadows, near Cazadero,

amas River at intake, near Cazadero, Oreg.

ar Cougar, Wash., 1909.
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od Lake, near Lewis, Wash., 1911–
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utte Creek), at Butte Falls, Oreg., 1910–11;

ad of Little Butte Creek), near Lake Creek,

, Oreg., 1907–
ake, near Lake Creek, Oreg., 1914; 1915–
Brownsboro, Oreg., 1913; 1915.
k, near Lake Creek, Oreg., 1911–1913.

- Rogue River tributaries—Continued.
  - Bear Creek at Talent, Oreg., 1907–1914.
  - Bear Creek at Medford, Oreg., 1915–
    - Neil Creek near Ashland, Oreg., 1913.
      - George Dunn ditch near Ashland, Oreg., 1913.
    - Ashland Creek at Ashland, Oreg., 1913.
    - Wagner Creek near Talent, Oreg., 1913.
  - Evans Creek at Wimer, Oreg., 1913.
  - Applegate River near Buncom, Oreg., 1911–1914.
  - Applegate River at Murphy, Oreg., 1907–1910.
    - Cameron ditch near Buncom, Oreg., 1911–1914.
    - East Fork of Little Applegate River near Buncom, Oreg., 1913.
    - Little Applegate River near Ruch, Oreg., 1913.
      - West Fork of Little Applegate River near Buncom, Oreg., 1913.
        - Spicer ditch near Buncom, Oreg., 1913.
      - Thompson Creek near Applegate, Oreg., 1913.
      - Slate Creek at Wonder, Oreg., 1913.
    - Grave Creek near Placer, Oreg., 1913.
- South Umpqua River (head of Umpqua River) near Tiller, Oreg., 1910–11.
- South Umpqua River near Brockway, Oreg., 1905–1912.
- Umpqua River near Elkton, Oreg., 1905–
  - Cow Creek at Riddle, Oreg., 1911–12.
  - North Umpqua River at Tokeetee Falls, near Hoaglin, Oreg., 1908–1909; 1914–
  - North Umpqua River near Hoaglin, Oreg., 1910–1912; 1914–
  - North Umpqua River near Oakcreek, Oreg., 1905–1908; 1913–1915.
  - North Umpqua River at Winchester, Oreg., 1908–1913.
  - Calapooya Creek near Sutherlin, Oreg., 1912–13.
    - Luse canal near Sutherlin, Oreg., 1912–13.
  - Mill Creek near Ash, Oreg., 1907–1912; 1915–
- Siletz River at Siletz, Oreg., 1905–1912.
- Wilson River near Tillamook, Oreg., 1915–
  - North Fork of Wilson River near Tillamook, Oreg., 1913–1915.
- Nehalem River at Salmonberry, near Balm, Oreg., 1913–14.

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STATES GEOLOGICAL SURVEY.

PPLY PAPERS.

logical Survey as long as its stock lasts. An asterisk (*)
Iany of the papers marked in this way may, however,
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btainable from Government sources. Water-supply

ashington, by I. C. Russell, 1897. 96 pp., 7

south by Oregon, on the east by Idaho, on the north
e Columbia," and "briefly designated as lying south
tation, topography and drainage, geologic formations—
rigation, and the artesian water supply, and gives an
gion.

ates, by Henry Gannett. 1901. 100 pp.,

olumbia, Willamette, Flathead, and Snake rivers.

Perce County, Idaho, Part I, by I. C. Rus-
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z Perce County, Idaho, Part II, by I. C.

western Idaho, bordered on the west by portions of
ugh Snake River to the Columbia; they describe the
gion, discuss the relation of the surface features—pla-
ology and the climate, the source and quantity of the
sian wells, and refer briefly to the occurrence of build-
er. They include also a short bibliography of artesian
list of elevations, and the other notes concerning Port-

ortion of Yakima County, Wash., by G. O.
0c.

agriculture, geology, and surface and ground waters
iles in the vicinity of North Yakima; discusses in some

e United States, Part I (Alabama-Montana),
. 5c.

the United States, Part II (Nebraska-Wyo-
67 pp. 5c.

to depth, diameter, yield, and head of water in borings
Remarks" gives information concerning temperature,
tc. The lists are arranged by States, and the States
revised, edition was published in 1905 as Water-Supply

*78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River Plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the conditions on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to control the use of artesian waters; gives list of publications bearing on artesian waters.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer, 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Investigations in Idaho, by D. W. Ross. Describes the irrigable lands in the area drained by Snake River.

Investigations in Oregon, by J. T. Whistler. Mentions the Umatilla, Malheur, and Harney projects.

Work in Washington, by T. A. Noble. Describes the plains of Columbia River.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives an account of a flood (commonly spoken of as the "Heppner disaster") on Willow Creek, a tributary of Columbia River, in Morrow County, Oreg.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. [Superseded by No. 152, q. v.]

Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

111. Preliminary report on the underground waters of Washington, by Henry Landes. 1905. 85 pp., 1 pl. 10c.

Describes, by counties, the municipal water supplies, deep wells, and springs in the State, giving also for each county a brief account of the climate, rainfall, topography, drainage, and geology.

118. Geology and water resources of a portion of east-central Washington, by F. C. Calkins. 1905. 96 pp., 4 pls. 5c.

Describes briefly the topography, geology, climate, vegetation, grazing, and agriculture on the Columbia Plains and in Kittitas Valley; discusses the streams, springs, and shallow and deep wells.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts relating to ground waters in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives, by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates (p. 85) of flood discharge and frequency for Boise River at Boise and Weiser River at Weiser, Idaho.

ne Harney Basin region, Oregon, by G. A.
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oy this report is in the Great Basin, but a small tract in
number of small streams that are tributary to Malheur

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basins of Klickitat, White Salmon, Little White Sal-
ults of observations at gaging stations, and estimates of
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the industrial application of water analyses,
pp. 15c.

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nage basins, by F. F. Henshaw and G. L.
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nomic features of the State, the constituents and uses of
r, methods of analysis, and industrial and geochemical
describes the general features of the principal drainage
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ition of river water, the economic value of the rivers,
al features on the character of the waters.

tilization, by F. F. Henshaw, John H. Lewis,
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h the State of Oregon, containing the results of meas-
f the economic distribution of the water, and chapters
ity of the water supply, the developed water powers, un-
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l Government permits for power and reservoir sites.

rk Fork of Columbia River, Montana-Idaho-
direction of R. B. Marshall, chief geographer.
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sin, Idaho, prepared under the direction of
. 1914. 12 pp., 3 pls. (37 sheets). 55c.

348. Profile surveys in Hood and Sandy River basins, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 2 pls. (6 sheets). 30c.

349. Profile surveys in Willamette River, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 3 pls. (16 sheets). 30c.

363. Quality of the surface waters of Oregon, by W. Van Winkle. 1914. 137 pp., 2 pls. 20c.

Describes the topography, drainage, rocks and soils, climate, population, and industries of the State, the constituents of natural waters, water for domestic and industrial uses, and purification of water, methods of analysis, and interpretation of results of analysis; describes the general features of the river basins and the character of the river waters; discusses the conditions influencing the quality of the surface waters, average chemical composition, geochemical character, denudation, industrial value, and value for irrigation.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of Soap and Omak lakes, Wash., and of mine waters from Butte, Mont.

366. Profile surveys of Snoqualmie, Sultan, and Skykomish rivers, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 3 pls. (12 sheets). 20c.

368. Profile surveys in Wenatchee River basin, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 1 pl. (8 sheets). 20c.

369. Water powers of the Cascade Range, Part III, Yakima River basin, by G. L. Parker and F. B. Storey, 1916. 169 pp., 20 pls 45c.

Describes the geography of the basins, the geologic history, physiography and river history, climate, settlement, and development, population, and transportation; gives stream-flow records and discusses natural conditions affecting stream flow, storage reservoirs, developed and undeveloped power sites; treats also of the industrial development of the region, discussing irrigation by gravity systems and by pumping, the production of coal and other minerals, and manufacturing; presents a scheme of development and utilization of stored water. The report was prepared under the direction of the Washington State Board of Geological Survey, and is based on data consisting of "stream-flow records, river plans and profiles, reservoir surveys, and field reconnaissances of the rivers and their various tributaries," obtained by the United States Geological Survey and the United States Reclamation Service, supplemented by a large amount of information furnished by private parties.

370. Surface water supply of Oregon, 1878–1910, by F. F. Henshaw and H. J. Dean. 1915. 829 pp., 1 pl. 45c.

Describes briefly the natural features of Oregon and in greater detail the general features of the river basins; consists principally of records of stream flow that have been carefully studied and recomputed when necessary to insure their best possible interpretation.

376. Profile surveys in Chelan and Methow River basins, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1915. 8 pp., 5 pls. 15c.

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sites and irrigable lands, field and office methods, and
some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp. 30 pls. and maps. $1.25. Contains:

*Hydrography, pp. 1-110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111-200. Defines the scope of the work and gives an account of the survey in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*Topography, pp. 291-343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345-388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the Director of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213-361, Pls. 58-106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III. Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351-427, Pls. 147-182. Describes structures on the Pocatello canal, Idaho.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457-533, Pls. 35-39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xvii, 400 pp., 110 pls. $1.25. 16 maps in separate case, 75c. Contains:

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*Washington Forest Reserve, by H. B. Ayres, pp. 283-313, Pls. 76-100.
*Eastern part of Washington Forest Reserve, by M. W. Gorman, pp. 315-350, Pl. 101.
*Forest conditions of northern Idaho, by J. B. Leiberg, pp. 373-386, Pls. 109-110.
These reports describe the topography and the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xix, 498 pp., 159 pls., 8 maps in separate case. $2.80. Contains:

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*Bitterroot Forest Reserve, by J. B. Leiberg, pp. 317-409, Pls. 115-142. Contains brief descriptions of the streams and lakes in the reserves.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Mount Rainier Forest Reserve, Washington, by F. G. Plummer, pp. 81-143, Pls. 33-50.

*Olympic Forest Reserve, Washington, from field notes by Arthur Dodwell and T. F. Rixon, pp. 145-208, Pls. 51-70.

*Cascade Range Forest Reserve, Oregon, from T. 28 S. to T. 37 S., inclusive, together with the Ashland Forest Reserve and adjacent forest regions from T. 28 S. to T. 41 S., inclusive, and from R. 2 W. to R. 14 E., Willamette meridian, inclusive, by J. B. Leiberg, pp. 209-498, Pls. 71-84. Contains descriptions of many of the streams flowing through the forest reserves.

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by contour lines, the shapes of the hills and
of all points in the quadrangle. The areal-
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ld springs and cold artesian waters, and hot springs and

, and vegetation of the area; discusses the geologic history
Economic geology," the surface waters available for irri-
nd the artesian wells; indicates areas of possible artesian

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cific slope basins covered by topographic maps and by
st addressed to the Director, U. S. Geological Survey,

104. Silver City, Idaho. 5c.

Describes the relief, drainage, climate, vegetation, and culture of the Silver City quadrangle; discusses the geologic history and the geologic formations, and, under "Economic geology," the surface waters available for irrigation or water-power development, warm springs, and artesian wells; notes possible chances for artesian waters; gives records of wells near Enterprise and Guffey; see also Water-Supply Paper 78.

*139. Snoqualmie, Washington.

Describes the relief and drainage of an area including portions of Kittitas, Yakima, Pierce, and King counties; the statigraphic, structural, and historical geology, and, under "Economic geology," includes a brief paragraph on the utilization of the water supply.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the northern Pacific coast drainage basins are the reports of the commissioner of conservation of the State of Montana; the State land commission; the State engineer of Idaho; the Bureau of Industry, Agriculture, and Irrigation of Nevada; the State engineers of Nevada, Oregon, Utah, and Washington; the annual reports of the United States Reclamation Service; and the reports of the Chief of Engineers, U. S. Army. The following reports deserve special mention:

The Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and National water laws, with a detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests: Helena, 1911; also report of the governor of the State of Montana on the same subject.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the appropriation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bur. of Industry, Agr., and Irr. Bull. 8, 1913.

The water resources of Washington: Potable and mineral water, by H. G. Byers; artesian water, by C. A. Ruddy; water power, by R. E. Heine: Washington Geol. Survey Ann. Rept. for 1901, vol. 1, pt. 5, 1902.

Preliminary report on the Quincy Valley irrigation project, by Henry Landes and others: Washington Geol. Survey Bull. 14, 1912.

Biennial Report of the State Commissioner of Arid Lands [Washington], 1895–96 and 1897–98.

The irrigated lands of the State of Washington, by George M. Allen, deputy commissioner: State Bureau of Statistics and Immigration, 1910.

Irrigation laws of the State of Wyoming, prepared for publication in the office of the State engineer, 1909.

LOGIC REPORTS OF GENERAL
REST.

reports not readily classifiable by
wide range of hydrologic investi-

PLY PAPERS.

M. Wilson. 1896. 56 pp., 9 pls.
vindmills, water wheels, and various kinds of engines;
vater until needed for irrigation.

1897. 100 pp., 4 pls. (See Water-Supply

by intermittent filtration and by irrigation; describes
d, and France, and sewage purification in the United

rphy. 1897. 49 pp., 8 pls. 10c.
vindmills during the summer of 1896 in the vicinity of
d methods and draws conclusions.

er lifts used in irrigation, by O. P. Hood,

r lifts of various types.

). Perry. 1899. 97 pp., 12 pls. 15c.
ind wheels, compares wheels of several types, and

Rafter. 1899. 100 pp., 7 pls. 15c.
r 3; discusses pollution of certain streams, experi-
n Massachusetts, value of commercial fertilizers, and
ts by States; contains bibliography of publications
l.

omic use, Part I, by E. C. Murphy. 1901.

omic use, Part II, by E. C. Murphy. 1901.
10c.
experimental tests with windmills of various types

nals, flumes, and pipes, by Samuel Fortier.

01. 51 pp., 12 pls. 15c.
rvey in 1901-2. See also Nos. 64, 94, and 95.

by E. C. Murphy. 1902. 99 pp., 4 pls.

ty of water and of measuring and computing stream
h the different instruments and methods; describes
rnell University hydraulic laboratory. A second,
ply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effects of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this paper should be addressed to the U. S. Reclamation Service.]

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.

*95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiments relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

oil-well wastes, by R. L. Sackett and Isaiah
s. 5c.

tion of streams by sewage and by trade wastes, describes
gives results of various experiments in disposing of the
riefly the topography, drainage, and geology of the region
n of rock wells and of streams by waste oil and brine.

nited States; M. L. Fuller. geologist in charge.

nderground waters," by M. L. Fuller, discussing sources
permeability and storage capacity of rocks, water-bearing
ings, wells, and pumps, essential conditions of artesian
g ground waters in eastern United States.

gress reports of the United States Geological.
Hoyt and B. D. Wood. 1905. 253 pp. 15c.

of papers relating to underground waters pub-
eological Survey. 1879–1904. by M. L. Fuller.

d waters, by D. W. Johnson. 1905. 55 pp. 5c

aters, gives common-law rules relating to their use, and
em.

of movement of underground waters. by C. S.
ls. 15c.

nsmit water, describes measurements of underflow in Rio-
er valleys, Cal., and on Long Island, N. Y., gives results
and describes stovepipe method of well construction.

pipes on a working scale. by J. H. Quinton.

of eastern United States, 1905: M. L. Fuller,
0 pp., 6 pls. 10c.

rest as follows:
s, by Robert E. Horton.. Discusses efficiency, cost, and
tatistics of such wells in southern Michigan.
d geyser springs, by Myron L. Fuller.
ow artesian heads, by Myron L. Fuller.

of engineers of the Reclamation Service. with
ed by F. H. Newell. chief engineer. 1905.
cerning this report should be addressed to the

ization of the hydrographic [water-resources] branch and
onferences and committees, circulars of instruction, and
y related to reclamation, and a bibliography of technical
Of the papers read at the conference those listed below
or less general interest:
y Morris Bien.
tion problems, by O. H. Ensign.
projects, by A. L. Fellows.
N. C. Grover.
ammond.
F. W. Hanna.
data concerning basins of streams gaged by R. E. Horton
m flow, by R. E. Horton.
truction camps, by M. O. Leighton.
, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable gaging station, by E. C. Murphy.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.

*150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation changes due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground-water developments, and to indeterminate causes.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905; lists publications relating to ground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation; treatment of slop; sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

n of Boston sewage, by C.-E. A. Winslow and
25c.

urification, and treatment of sewages and tendencies in
l, Germany, and the United States; describes character
of suspended matter, treatment in septic tanks, and puri-
a and coarse material; gives bibliography.

vastes, a report based on investigations made
Stabler. 1906. 36 pp., 1 pl.

ron wastes at Shelby, Ohio, and resulting litigation; dis-
vage purification processes, recovery of copperas from acid-
emoval of pickling liquor.

ring the frozen season, by H. K. Barrows and
1 pl. 15c.

tion by strawboard waste, by E. B. Phelps.

oard, present and proposed methods of disposal of waste
recipitation and sedimentation, and field studies of amount
terial and finished product, and mechanical filtration.

ippi rivers by Chicago sewage (a digest of the
f the State of Missouri v. the State of Illinois
Chicago), by M. O. Leighton. 1907. 369 pp.,

of title.

and formulas (revision of paper No. 150), by
., 38 pls. 35c.

hite-pulp waste, a study of possible remedies,
pp., 1 pl. 10c.

pulp, the waste liquors, and the experimental work lead-
eventing stream pollution.

sewage filter effluents, with a chapter on the
sewage effluents, by E. B. Phelps. 1909. 91

ater resources. 1909. 96 pp., 2 pls. 15c.

se scope is indicated by their titles: Distribution of rainfall
. Leighton; Developed water powers, compiled under the
ussion by M. O. Leighton; Undeveloped water powers, by
H. Newell; Underground waters, by W. C. Mendenhall;
nan Stabler; Control of catchment areas, by H. N. Parker.

and other factory wastes, by Herman Stabler
pp. 10c.

scouring, bleaching and dyeing cotton yarn, bleaching
of oleomargarine, fertilizer, and glue.

the United States, Part I, Analyses of waters
eridian, by R. B. Dole. 1909. 123 pp. 10c.

ethods of examination, preparation of solutions, accuracy
tical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvements of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall; water-bearing rocks; amount of ground water; artesian conditions; oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties, contamination of well waters and methods of prevention, tests of capacity and measurement of depth, and costs of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March-April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(*e*) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65.

364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells shelters, and structures for making discharge measurements and artificial controls.

ogy of the United States. 1915; N. C. Grover, chief
. 181 pp., 9 pls. 15c. Contains:

aging to the science of hydraulics, by C. H. Pierce and R. W.

iver discharge for a changing stage, by B. E. Jones, pp. 117-130.
use of automatic gages in obtaining records of stream flow, by

the conference of engineers of the water-resources branch in

logy of the United States, 1916; N. C. Grover, chief
pp., 7 pls. Contains:

water-power resources, by G. O. Smith, pp. 1-8.
-laden streams, by R. C. Pierce, pp. 39-51.
data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

y of water witching, with a bibliography, by Arthur
10c.

merely to furnish a reply to the numerous inquiries that are con-
all parts of the country" as to the efficacy of the divining rod for

ology of the United States, 1917, N. C. Grover, chief
18. Contains:

ables and convenient equivalents, pp. 71-94. 1917.

ANNUAL REPORTS.

nited States Geological Survey, 1883-84, J. W. Powell,
vi, 469 pp., 58 pls. $2.25. Contains:

ying conditions of artesian wells, by T. C. Chamberlin, pp. 125-173,
title.

nited States Geological Survey, 1890-91, J. W. Powell,
rts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2.

I. M. Wilson, pp. 363-561, pls. 107 to 146. See Water-Supply Paper 87.

the United States Geological Survey, 1891-92, J. W.
92. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irriga-
ls. $1.85. Contains:

gineering, by H. M. Wilson, pp. 101-349, pls. 111 to 146. Discusses
f irrigation, alkaline drainage, silt, and sedimentation; gives brief
cribes perennial canals in Idaho, California, Wyoming, and Arizona;
t reservoirs of the California and other projects, subsurface sources of
birrigation.

f the United States Geological Survey, 1892-93, J. W.
893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying
73 pls. $2.10. Contains:

of eastern United States, by W J McGee, pp. 1-47. Discusses cistern
d ground waters, including mineral springs and artesian wells.
ers of the United States, by A. C. Peale, pp. 49-88, pls. 3 and 4. Dis-
w of mineral springs, the source of mineralization, thermal springs, the
d analysis of spring waters, geographic distribution, and the utilization
a list of American mineral-spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium, and through sand, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate, and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee River basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

*479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

AREAS AND SUBJECTS.

— **Bulletin**; P— Professional Paper; W— Water-Supply Paper;
G F— Geologic folio.]

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OF MASSACHUSETTS.

E and H. J. DEAN.

DUCTION.

N C. GROVER.

chusetts have at all times played an and commercial development of the ent and growth of the English colo- incipal lines of communication and r small industrial uses in the grinding l, in the carding of wool and in the the medium for transporting logs Thus, these valuable resources were water-power plants contributed to colonies and to the needs and welfare moved from the world's markets of argely dependent on local products, material, fuel, and clothing, but for n their farms and in their homes. ere established and towns grew up water powers.

powers have been put have changed tions and the needs of a growing and e heavy forests have disappeared mack rivers still carry logs from the ire and Vermont. Flour and meal vely large local plants or in the still the need for the small neighborhood e sawmills, gristmills, and wool- ed by the machine shop, the paper variety of manufacturing plants for become noted. The small industrial monwealth times have grown to be and commercial centers of to-day. l scores of smaller cities still depend on water power as the principal source of energy, although steam plants have been constructed to supplement the power obtained from the rivers. The new conditions have also brought forth new uses. Water is needed in the industries that have been developed and in the towns and cities that have been built.

With improvements in electric transmission of power it is no longer necessary to use the power at the place of its generation. The power developed on Connecticut River near Brattleboro, Vt., and on Deerfield River in Massachusetts and Vermont is now being utilized to supplement the steam and water power in many cities and towns of the Commonwealth, and many small hydroelectric plants supply nearby cities and towns with power. The development of other power sites in Massachusetts and of more distant sites of great capacity in Maine and New Hampshire for transmission to the manufacturing cities of Massachusetts has been proposed.

Recent years have seen still another important change in the use of power. The electric light and the electric railroad have revolutionized the lighting of the home and transportation in the cities and towns. Electric heating and electric cooking in the home are still largely in the future. The interest of the people in the power resources of the State and community, great as it was in colonial times, is still greater and more intimate to-day. This fact is recognized in the large measure of control of the public utilities exercised by the Commonwealth and by municipalities. As Director Smith has stated,[1] "The most notable sign of the times is in the general acceptance of the principle of public control." The use of rivers as sources of public water supplies for cities and towns and the necessity for conserving the supply and protecting the quality in order that the individual may have at all times sufficient potable water bring forcefully to the attention still another phase of the water resources that is of immediate interest to all the people.

The construction of a water-supply system for the metropolitan district including Boston and the near-by cities is reckoned among the engineering triumphs of modern times. The protection afforded to the municipal water supplies by the Massachusetts Board of Health has served as a model for other States.

The various uses of the surface waters have from colonial times been considered of public benefit and therefore of interest to all the people. Many uses have been declared to be public uses and placed under public control, in accordance with the tendency of the present times. In January, 1916, the United States Supreme Court rendered a decision which defined "public use" in the following words:

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[1] Smith, G. O., The people's interest in water-power resources: U. S. Geol. Survey Water-Supply Paper 400, p. 4, 1916.

and to draw from them energy, labor without
l that it can be spared, is to supply what, next
all our achievements and all our welfare. If
at a loss to say what is.[1]

herefore increasing. Uses are chang-
uses are gradually superseding the
conomic law. As these changes take
ntity of water in the streams and of
eason and year to year is necessary.
e stream-flow data has been made,
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asis for future studies of this valuable
rt includes the classic records collected
nd Lawrence, on the Connecticut at
e and Sudbury by the Metropolitan
well as records covering shorter peri-
he light of the best available informa-
y and possible, and they are presented
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ERATION.

y Federal and State legislation, the
eological Survey and the governor of
setts entered into a cooperative agree-
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rent periods of cooperation. Assist-
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N OF WORK.

n under the direction of F. H. Newell,
rover, district hydrographer, and were
by H. K. Barrows, for a few weeks in
1910 to 1914 by C. C. Covert, and
Pierce. Many assistants have par-
d their names appear in connection
listed in this report. The ratings,
w during winter periods, and special

916, Mt. Vernon-Woodberry Cotton Duck Co. et al. vs.

studies for this report have been made by C. H. Pierce, district engineer, and H. J. Dean, assistant engineer. Hardin Thweatt, junior engineer, W. A. Elwood, clerk, and G. F. Adams, field assistant, assisted with the computations. The manuscript was prepared by H. J. Dean.

TOPOGRAPHY.

By Arthur Keith.

PRINCIPAL FEATURES.

A bird's-eye view of Massachusetts would reveal three belts of high ground and four of lowland trending southward across the State. In general each lowland belt is lower than the one next west of it, and each slopes southward with the streams. Likewise each intervening belt of high ground descends as a whole toward the south and each in turn is lower than the belts at the west. The sum of these features is that the highest part of the State is in the northwest corner and the lowest is in the southeast.

The State is drained by two great rivers, the Connecticut and the Merrimack, and by many smaller ones. As a whole the direction of stream flow in the State is decidedly southward, and no stream crosses any of the uplands.

Connecticut River enters the State from the north and flows southward directly through it, cutting off its western quarter. The river flows nearly midway between the borders of its basin, which includes about one-third of the State. In Massachusetts the river has two main branches on the west, Deerfield and Westfield rivers, and two on the east, Millers and Chicopee rivers.

Merrimack River also enters Massachusetts from the north but within 6 miles turns northeastward and empties into the Atlantic Ocean near the northeast corner of the State. Nashua and Concord rivers, its principal tributaries, are nearly as large as the branches of Connecticut River. They flow northeastward and, with the Merrimack, are the largest exceptions to the general trend.

The Charles and Ipswich, somewhat smaller rivers, also flow northeastward into the sea. Taunton River and its branches have general southerly directions and empty into Narragansett Bay. The area along the western border of the State is drained by Housatonic River, which flows southward parallel to the Connecticut, and by Hoosic River, which has a general westward course to the Hudson. Quinebaug and Blackstone rivers drain the south-central marginal part of the State, the former flowing southward to Long Island Sound and the latter into Narragansett Bay.

There are three main divides between the different river systems of the State. One runs southward nearly through the State and divides it roughly into halves. Another, parallel to this, crosses the State 10

ary. Between these divides lies the
hird main watershed, which cuts the
nearly equal parts, has an average
the Connecticut Valley. This divide
ly into Long Island Sound from those
l those that flow northeastward into
are remnants of the original divides
cal features of the State.

e to the prevalence in it of rocks that
treams and weather, and in contrast
e presence of rocks that are weak and
nts. These leveling processes, con-
s, have carried to the sea the tops of
to which the rocks have been forced
ountains and hills of to-day are but
past. During numerous epochs the
carried so far that broad tracts were
ater uplifts of the land steepened the
renewed speed and power cut down
valleys into new plains. Thus each
ateau, which was then cut down in
plains. The remnants of the older
rious levels as high as 2,200 feet.

istic of the State; several of them are
nd a similar succession of surfaces
They are arranged like giant plat-
the west; each step is cut deep into
over great areas no trace is left of the
e series of the higher surfaces is pre-
and that of the lower surfaces in the

crust are crystalline; that is, they are
it firmly together. The higher rocks
are made up of the worn and sorted
to which the surface has from time
class the sedimentary rocks, such as
are less firm than the deeper crystal-
r schist, and so have been cut down
d belts have resulted directly from
stones, shales, slates, and sandstones.
e rocks is due largely to the manner
or broken by the earth's forces.

sed rocks or basins, corresponding
dimentary rocks, were formed, and

between them were raised three masses or huge arches of deep-lying crystalline and igneous rocks. Although each arch differs from the other arches and each basin from its fellows, they have this controlling feature in common—that each arch exposes crystalline rocks that are harder and older than those of the adjoining basins, whereas each basin contains sedimentary rocks that are younger and softer than those of the arches on its flanks. The coastal plain contains only gravel, sand, and clay, and is the lowest division of the State.

To sum up these facts, each upland belt stands up because it contains relatively hard rocks like granite, gneiss, or schist, and these were uplifted from the depths of the earth's crust in rude, enormous arches; each lowland belt is worn down on weaker rocks like limestone, shale, or sandstone, which were depressed in deep basins or sunken blocks of the crust. After the various foldings were completed the surface was worn down almost to a plain. Then the whole region was lifted again and again by hundreds of feet, the streams began their wear anew, and lower plains were formed between the remnants of the old ones. Thus the huge overtopping masses of the ancient folds were worn to the roots, and the series of plains became the great plateaus of to-day.

Then came the invasion of glaciers from the far North. Beneath these vast ice sheets the highest mountains in the State were buried, the rocks were smoothed and ground off, and their fragments were carried to great distances. In places the valleys were somewhat deepened; in places they were filled with waste rock. Finally the great ice mass melted away and left a blanket of bowlders, sand, and clay called the glacial drift. This filled the valleys, blocked or diverted the streams, and formed new ridges and hills that are prominent features in the lowlands. Cape Cod, the most prominent feature of the New England coast, owes its very existence to the mass of drift deposited around the end of one lobe of the glacier. Another lobe produced the high ground and the islands that outline Buzzards Bay on the southeast. The principal features of Marthas Vineyard and Nantucket resulted from an earlier and farther advance of these glacial lobes.

The land rose, when freed of its great load of ice, and the streams began to cut into their new channels. As the channels deepened, high parts of the bedrock were uncovered and resisted the wear of the streams so as to stand above the sands and clays, forming waterfalls and rapids. These were destined to provide the locations of the early mills and thus to lay the foundations for the manufacturing eminence of the State.

The latest geologic episode, the slow sinking of the land, has had a marked influence on the geography and industries of the State. The deep river valleys were first submerged and became the great inlets

agansett bays. Lesser valleys formed
in Gloucester and Salem, or shallow,
iouth and Duxbury harbors, or other
River and New Bedford. The beat of
t fast cut away the sand and clay and
g, slim bars and beaches, which now
p harbors, like those of Boston, Prov-
and scores of shoaler ones, as in Dux-
llow harbors are very numerous north
isset. The existence of these numerous
pursuits of fishing, trading, and ship
ider the State prominent in commerce.
ut across the inlets, the latter fast filled
eposits. The greatest of these marshes
oast from Essex, Mass., to North Hamp-

a level has also increased somewhat the
rs. Taunton and Merrimack rivers are
is increase, but even small streams like
s, which are navigable for ocean-going
important in their added water front for
at shipbuilding yards of America is 4 miles
mouth Fore River, a small tidal stream.
the only stream in the State that is navig-
the Merrimack, which is used by small craft
from its mouth.

ater of the State is found in the ponds and
ates are so well supplied. The ponds fill
acial drift and range in size from bodies like
River, 7.7 miles long, down to tiny ponds
re. They are most numerous on Cape Cod,
e central upland and the eastern lowland.
nds tend to be longer in a north-south direc-
e prevailing trends of the hills and valleys.
partly filled and are used as cranberry marshes.
ds, and reservoirs more than 10 acres in area
ppendix to the report of the Massachusetts
for 1873. The total number listed was 1,206,
a 93,000 acres. In the gazetteer forming the
t many of the lakes named on the maps are

districts have been formed in the State as the
ns above described. These districts, named in
st, are (1) the Taconic Range, along the western
(2) the Housatonic Valley (including the Hoosic

Valley); (3) the Green Mountain highlands (including the Berkshire Hills); (4) the Connecticut Valley; (5) the central upland; (6) the eastern lowland; (7) the coastal plain.

TACONIC RANGE.

Only the eastern portion of the Taconic Range comes into the State, most of it being in New York and Vermont. Its highest summits are along its eastern margin, and Mount Greylock, 3,505 feet, the highest peak in Massachusetts, stands in its northern part. Other high peaks on the range west of Greylock are East Mountain, 2,660 feet, and Berlin Mountain, 2,804 feet. Toward the south the altitudes are in general less, and Mount Everett, near the southwest corner of the State, stands at 2,624 feet, nearly 1,000 feet lower than Mount Greylock. The main watershed of the range in Massachusetts follows its high eastern part from Greylock to the southwest corner of the State and divides the Hudson waters from those of Housatonic and Hoosic rivers.

There are many lesser mountains and ridges in the Taconic Range, and they are separated by numerous deep lengthwise valleys and by cross gaps or passes. The summits at the north are more even than those at the south, but there is throughout the range a noticeable development of single peaks. The northern ridges have a general north-south trend and tend to be parallel, but these features are less marked toward the south. There is more variety in the summit heights of this range than in those of the other upland districts, but the high plateaus seen in the Green Mountain highlands are imperfectly shown here, especially in the southern part of the range in Mount Washington. The most prominent feature of the range is its steep escarpment on the east, where it towers above the Housatonic Valley. Its western parts descend rather steadily and pass into the lowlands of the Hudson Valley in New York. The general steepness of the slopes causes a very rapid run-off of the waters.

The part of the Taconic Range in Massachusetts is carved almost wholly from slates and schists, and to the superior hardness of these rocks is due its prominence above the limestones of the Housatonic Valley. The schists are harder than the slates and lie at the east, causing the greater heights of the eastern parts of the range.

The Taconic Range is steep and rugged in Massachusetts, and its upper parts are poorly adapted to settlement. The passes from east to west and the deep lengthwise valleys have, however, made traffic through the range much easier than in the Berkshires. The early farming communities settled towns in the valleys, and these sites were confirmed by the later development of manufacturing near the water powers and railroads.

NIC VALLEY.

ie the valleys of Housatonic River,
Island Sound, and of Hoosic River,
ward to the Hudson. Hoosic River
of about 570 feet, and Housatonic
t the head of the two rivers is 1,120
the valley floor lies between 700 and
places much below the valley floors,
y pass through narrows and gaps in
rn down along the soft marbles and
ds into all their projections wherever
rocks, thus forming deep bays in the
h indented outline of the Housatonic
r Stockbridge, Pittsfield, and North
trend about northward or southward
southeastward into the Berkshires,
of the near-by slates and gneisses.
m rise scattered ridges or islands of
Mountain, 2,150 feet above the sea,
eet.

been removed from the valleys, and
kept pace with the down wear of the
emnants of older and higher surfaces
ream cutting, as is well shown around
f 1,140 feet, and around Pittsfield,
50 to 1,100 feet. The Housatonic
vel of the older surface, but below
ader, younger, and lower valley with
The Hoosic has cut a narrow valley
old plateau. In both valleys many
thed out by the deposits of sand and
the melting glaciers. These deposits
Pittsfield and along the Housatonic
at some places produced hills and

ys form a great natural thoroughfare
ing settlements grew up on their
and were later strengthened by the
lls were located on the water powers
e the streams emerge upon the plains
n Mountain highlands. The railroads
s the obvious opening for traffic north
ey thoroughfare intersects the lines
sses of the highlands, the flourishing

cities of Pittsfield and North Adams have grown. From this channel has also spread the tide of summer travel that makes the scenery and climate of the region so great a natural asset.

GREEN MOUNTAIN HIGHLANDS.

General features.—Rising boldly above Housatonic Valley on the west and Connecticut Valley on the east. are the Green Mountain plateaus, a belt of highlands about 25 miles wide, running southward across the State. Their northern part contains Hoosac Mountain, one of the most prominent heights in the State. This range is the south end of the Green Mountains of Vermont, and the highlands are the worn-down remnants of the earlier mountains. The western part of the highlands, in Berkshire County, is called the Berkshire Hills.

The area is drained mainly southeastward by Deerfield and Westfield rivers, tributaries to the Connecticut, and to a less extent by Farmington River and small branches of Housatonic and Hoosic rivers. The western half of the highlands is formed mainly from the ancient gneisses and granites, and the eastern half from later schists. The belt of ancient rocks widens greatly toward the south. The highlands owe their prominence to the hardness of the rocks beneath them, and the main divide and the higher mountains are at the west on the gneisses, the hardest of all.

These highlands have a distinct plateau aspect. The tops are broad and rounded and form rather even sky lines, and the streams have cut deep, narrow valleys or gorges many hundreds of feet below them. The segments into which the highland is cut have as a whole a marked southeasterly trend across the belt. The trend is northeasterly, however, in a narrow belt near Deerfield River. Just as the general outline of the highland area follows that of the crystalline rocks, so the drainage lines and ridges correspond very closely with the local trends of the rocks. This correspondence is especially notable in the area of gneisses, whose divisions contrast strongly in character. Exceptions to this rule are shown by the schist belts east of Hoosac Mountain and those in the extreme northeastern part of the highlands, where the ridges and valleys cross the rock belts.

About half the highland area is more than 1,500 feet above the sea, and much of the main watershed is higher than 2,000 feet. The main divide culminates in Hoosac Mountain, near the Vermont boundary, in a peak 2,800 feet high, and from this point the high ground falls away to the south and east. The main divide hugs the west border of the highlands and is usually within 5 miles of it. The summits of the highlands fall into three groups that are significant, with a vast number of others without system. Around the margin of the highlands one group stands 1,100 to 1,200 feet above the sea, the next highest from 2,050 to 2,200 feet. group at heights a little less than

ld and high plateau, these old surt only remnants are left. These l on the hardest rocks and near the le least power. Their summits fall ven that the plateau character is ivers run in huge trenches from 700 els. The view of the plateaus and Florida is very fine.

little affected by the great glacial surface were smoothed out, and were made. The chief result was l the consequent formation of lakes numerous here than in other parts eat beauty, and the part taken by y the setting of wooded mountains. highlands, with their rugged gorges, justly famed.

were so much better adapted to d towns were laid out on the hills. vater powers caused the location of eys. This process was emphasized d their diversion of transportation nds oppose so effective a barrier to setts only one natural pass across ere Housatonic River heads against ation of 1,470 feet. Deerfield River e highlands, but its use by a railroad Hoosac Mountain. This range was and its western scarp of 1,000 feet

CUT VALLEY.

ghly triangular and is about 4 miles he State, and 20 miles wide at the igh summit the valley appears pracighlands walling it on each side. It ut River, which flows southward in two main tributaries on each side, he east and Deerfield and Westfield cticut enters the State at 180 feet 5 miles downstream at an altitude of ween them are long stretches of slack water suitable for navigation by small boats. Even its main tributaries, however, have high grades and numerous falls on the hard rocks of the highlands.

The valley is underlain mainly by soft red or brown shale and sandstone, interbedded with which are several lava flows. The sandstones and shales have offered little resistance to the wear of the streams, so that the areas underlain by them were reduced to a low rolling plain. The sheets of lava or trap, however, have proved very resistant and stand up in the long, sharp crescent of the Holyoke Range, with summits at 1,214 feet in Mount Tom and 1,115 feet in Mount Norwottock, that reach the level of the highlands east and west of the valley. The low, rolling hills around its margin locally form groups with heights of 500 to 650 feet and of 300 to 340 feet, but far the greater part of the valley is below 300 feet.

The shape of the valley follows closely the outline of the soft red beds, and this was produced mainly by faults along which the surrounding older rocks were raised, leaving the red beds at low levels. At the extreme north end of the valley, near Bernardston, some low ground is formed by weak slates around the margin of the red beds.

Evidences of lower plain surfaces that were probably developed have been concealed by the deposit of glacial drift, which is very thick. The lower inequalities were completely buried in the sand brought down by the Connecticut and its tributaries. The deltas of the side streams formed miles of level plain, fine examples of which are seen around Springfield and Greenfield. Only here and there has the river in cutting down through these sand deposits uncovered the preglacial rock floor. At these places, such as South Hadley, Turners Falls, and Millers Falls, the hard ledges have caused waterfalls and powers that have attracted factories and settlements around them. Agriculture and the early settlements depending on it were fostered by the fertile soil and the levelness of the valley, and at later dates the valley formed a natural avenue for railroad traffic. The main east-west traffic line through Chicopee and Westfield valleys intersects the north-south artery of the Connecticut at Springfield and makes one of the most important cities of the State. The combination of these elements has produced a high concentration of population which approaches that in the eastern part of the State.

CENTRAL UPLAND.

General features.—The central upland includes the high part of the State between the Connecticut Valley and the lowland of eastern Massachusetts. It crosses the State in a north-south belt 34 miles wide at the north but narrowed to 20 miles along the Connecticut

Connecticut Valley, and on the east
h-south line through Princeton. It
nto Connecticut, but passes far into
ront of this upland rises sharply 700
cut Valley. The eastern margin is
t 600 feet above the eastern lowland.
Connecticut and Atlantic drainage
e more than 6 miles from the eastern
situated the highest peaks. Almost
onnecticut River by its tributaries,
lers rivers. The eastern part of the
l through Concord and Nashua rivers
eastward through Blackstone River
a along the southern border is drained
divides between the east-west streams
n lying near the south side of its basin.
within 2 miles of the main channel of
rd for 25 miles into Chicopee River.
of high rounded hills and ridges sepa-
he evenness of summits characteristic
st from any high summit. Above the
uch as Mount Wachusett, 2,022 feet;
; and Mount Grace, 1,628 feet; all in
d. In general, the plateau is slightly
mmits at the north being about 1,200
e at the south about 1,100 feet. This
t of the master stream, the Connecticut,
is no general difference of plateau level
the facts that the main streams flow
s so near the east border of the plateau.
land area, in addition to the principal
belt of much worn-down plateau rem-
tracts reduced nearly to lower plateau
mmits, about 900 feet in altitude, ap-
re plateau along the east margin of the
the hardness of the granites, gneisses,
st of it, as contrasted with weaker rocks

of the summits of the upland are like
but the valleys, although narrow like
not so deep (only 200 to 700 feet), be-
while the master stream is the same for
r of the Connecticut Valley the canyon-

like aspect of the stream is, however, as marked as in the Berkshires. There is a decided southerly trend to the ridges and smaller valleys, in spite of the fact that the main streams have a general westerly flow. This general trend is caused by the wear of the minor drainage lines northward or southward along the belts of weaker rocks. Although few of the ridges seem particularly long, owing to their blending in the view with the surrounding ridges of the plateau, many of them really extend for considerable distances. The one which runs through Shutesbury and Pelham near the Connecticut Valley is 20 miles long, and a large number of others are 8 or 10 miles in length.

Large irregular depressions were cut well across the plateau by Quinebaug, Quaboag, and Ware rivers, but only the areas close to the streams were reduced to any plateau level. There is also a major north-south valley running through Monson, Greenwich, and Orange, which is crossed by the main rivers and occupied by their tributaries. Numerous minor north-south valleys extend for long distances, although each may be occupied by several streams—for instance, the valley passing through Baldwinsville.

As in the Berkshire Hills, the early settlements in the central upland were agricultural, and many hill towns, like Petersham, Templeton, and Rutland, grew up on the rolling hill country away from the streams. With the increasing use of water power for manufacturing and the building of railroads through the valleys, manufacturing towns arose in them and far outstripped the hill towns. Millers River and Chicopee River with its branches, the Ware and Quaboag, formed the main passageways across the upland and were occupied by the east-west railroads. The north-south minor valleys, especially the Orange and Monson valley, were occupied by connecting railroads.

The form of the plateau was only slightly modified by glacial invasion. A thin sheet of bowlder clay was deposited over the plateau, and here and there areas were left bare and rocky. Sand deposits were formed in the valleys and filled some of them to considerable depths, but the main topographic lines were not obscured.

EASTERN LOWLAND.

General features.—The eastern lowland occupies about half of the area of the State. It is bounded on the east by the coastal plain which takes in the peninsula of Cape Cod and a narrow tract along Massachusetts Bay east of a line running through Onset, Kingston, and Scituate. Its western border is a belt of hilly country, from 2 to 4 miles wide, which lies west of Worcester and Fitchburg and forms the foothills of the central upland.

The larger bodies of high ground or ridges in the eastern lowland have distinct northeasterly courses, and the same trend is even more

valleys. This direction is in decided
ıd of the valleys and hills in the western
e shorter and have less obvious trends
rly all of them are smooth and rounded
edges, except in the Blue Hills and in a
tham to Gloucester. The valleys are
up most of the area.
one principal divide which separates
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e, east to Boylston, thence southeast to
hode Island, and north of east to the sea
divide the larger streams flow north-
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A minor exception to this rule is Black-
outheastward from Worcester through
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high country which stands upon the hard
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st of the high hill country that forms a belt
and is underlain mainly by granite. This
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northeast from Narragansett Bay nearly
by another hill belt that extends on granite
Fall River through Middleboro and nearly
d and hill belts are cut off at the northeast
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are nearly paralleled on the north by the
s northeast from Weston through Salem to
ge that reaches from Shrewsbury northeast-
The latter is the southeast divide of the
is held up by hard gneiss and schist. This
into Connecticut, is excavated in slates and
ne of the oldest valleys known in the State.
tion the northeastward-flowing streams of the
itheastern divides of their respective basins.
ng instance of this lack of symmetry, its main
aces more than 3 miles from its southeastern
rthwestern branches are from 15 to 25 miles
s, the most sinuous river in the State, follows
Another peculiarity of most of these rivers, in-
Sudbury, Ipswich, and Merrimack rivers, and
three branches, is that they all flow southeast-
courses and turn sharply northeastward into

The summits of the lowland fall into four groups of plateau-like surfaces. These are successively lower toward the east, and each group forms deep bays projecting westward into the higher ones. As a whole, they are like immense steps or platforms ascending to the central upland. The highest group forms a north-south belt across the State next to the upland. It has a fairly uniform width of 6 to 15 miles, and its hilltops range between 540 and 650 feet in altitude. Far from this group but rising to its level are the Blue Hills of Quincy and Milton, 500 to 640 feet, and Moose Hill in Sharon, 560 feet.

The next group forms a very irregular belt of hills between 320 and 380 feet above the sea. These are to be seen mainly around the margins of the river valleys and in the two hill belts northeast of Wrentham and Weston. Next below them is a group of hills between 220 and 260 feet above the sea, which are scattered over much of the State east of the two higher groups and almost reach the sea in Lynn. On the hills of this group in Lynn and Waltham there is scarcely any glacial drift and rock ledges are very numerous. In this feature these hills are surpassed by no other part of the State except the extension of the same belt northeastward into the promontory of Cape Ann. Much of this rocky hill country is to-day a wilderness, although situated in one of the most thickly settled districts of the United States. The summits of the lowest group range between 110 and 160 feet, and their areas form an irregular network along the coast and up the river valleys. Probably half of the area of the lowland southeast of the Quincy and Wrentham hill belt falls into this group.

In general aspect the eastern lowland is more modified by glacial action than the more western parts of the State. The commonest glacial features are the sand plains which fill the valley bottoms and rim their slopes. The next in abundance are the drumlins or smooth, rounded hills of bowlder clay with bases resting on the bedrock. These are scattered over both the valleys and hills, but are more numerous on the lower levels of the lowland than elsewhere. They are usually not more than half a mile long, and their axes run generally from northwest to southeast, the direction in which the ice moved.

South of the latitude of the Blue Hills rock outcrops are very scarce and there is an almost continuous cover of glacial drift. Bedrock is exposed more commonly to the north and west of Boston in the hill belts and higher country, but the valleys are deeply filled with glacial sand and gravel. The promontories of the bedrock at the ocean in Cohasset, Manchester, Gloucester, and adjoining towns form bold rocky shores, whose picturesque scenery attracts thousands of summer visitors. North of Cohasset the shore line is followed by numerous salt marshes, the largest of which extends from Essex for 16 wich, Parker, and Merrimack rivers

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ne ponds lie in all topographic situa-
ugh they are most numerous in the
d up by dams of glacial drift across
the largest, occupy hollows left by
est are Assawompsett Pond, in Lake-
pa Pond, in Fall River, 7.7 miles long.
onds that have been filled up by peat
vamps in West Bridgewater and Hali-
valley like those of Neponset and Sud-
light above a barrier of bowlder clay.
etely cut down in the area underlain
the lower Charles and Mystic valleys
as far south as Weymouth and Co-
consists of several small river valleys
sinking of the land since their forma-
still in progress, although exceedingly
d growth of the salt marshes. Narra-
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merged far inland by the settling of
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ls by the accumulations of sand and
se, when freed of its load of ice, the
to cut down their channels. In places
of the buried bedrock; these held up
le the stretches downstream, on the
excavated. Thus came into being the
eant so much to the manufacturing

at Lowell, Lawrence, and Haverhill
iest developed. Now this river is one
ams in the world, and with its tribu-

taries it has more utilized power than any drainage basin of equal size in America. The early mill settlements, like Lowell and Lawrence, have developed into the greatest textile centers of the Western Hemisphere. This early advantage was increased for Lowell by its position at the great bend of the Merrimack, which is the chief outlet for the traffic of the entire river valley in New Hampshire.

The power of the several falls of Blackstone River is now highly developed. It induced the early industries of many towns, such as Worcester and Blackstone, also Woonsocket and Pawtucket, in Rhode Island, at the State border. Similar falls determined the location of Clinton and Fitchburg on the branches of Nashua River, Medway and Newton on Charles River, and Milton on Neponset River. Other large towns, such as Fall River and Taunton, on Taunton River, took early advantage of the waterfalls.

COASTAL PLAIN.

The coastal plain of Massachusetts includes Cape Cod, the southern islands, and a narrow tract along the coast east of a line through Onset, Kingston, Marshfield, and Scituate. The coastal plain has no hard rocks at the surface, like the rest of the State, but is underlain by clays and sands that are deeply covered by glacial deposits.

The most prominent feature of the New England coast is Cape Cod, which projects from the mainland east of Buzzards Bay, and roughly has the shape of a man's bent arm. It incloses the south end of Massachusetts Bay, and its southwest prong, with the Elizabeth Islands, forms one side of Buzzards Bay. Between its south shore and the islands of Marthas Vineyard and Nantucket lie the shoal waters of Nantucket and Vineyard sounds. The Cape and the shoals around it are the greatest obstruction and menace to shipping on the Atlantic coast. To obviate this the Cape Cod Canal has recently been dug across the cape east of Bourne, at the head of Buzzards Bay. The Cape turns away from the northern shores of Massachusetts the warm currents from the south and holds back some of the cold Labrador current, and it thus causes a decided difference in the climate of the north and south shores.

The drainage of the coastal plain is very irregular. North of Plymouth the plain is crossed by several small streams. From Plympton the main divide runs southeasterly to the coast just north of Bourne. In Bourne it forks, one part going south to Falmouth and then southwest through the Elizabeth Islands, and the other part curving in a rude semicircle near the inner side of Cape Cod. Only one stream north of the divide is as long as 4 miles, and most of the drainage is southward from the divide. Large tracts draining into ponds with no surface outlets are very common, owing to the sandy

ndant on Cape Cod. The largest of
arwich, is 2½ miles long. These un-
ccupied by huge masses of ice while
round them from the margins of the

deposits in the State are seen along
nd Buzzards bays and on Marthas
these areas there are belts of very
h is 200 feet above the sea and con-
ds, irregular valleys, and hummocky
moraines formed by the dumping of
two great lobes of the glacier. The
Cape Cod was formed by one lobe,
th Islands and the east shore of Buz-
ther. These lobes nearly united, and
hem forms the high irregular country
similar loops during an eastern and
ed the high ground of Marthas Vine-
er hills were due to the great accumu-
nd the lower ground to the south was
f sand and gravel. These high mar-
oraines, curve broadly as a whole and
ribed. Large groups of the morainic
bove sea level between Plymouth and
le to the end of the Cape few exceed
ymouth, 394 feet, is the highest point
ighest ground east of the Wrentham
as Vineyard also includes numerous
the rest of the coastal plain lies below

ON OF TERMS.

g in a stream—the "run-off" or "dis-
ous terms, each of which has become
of work. These terms may be divided
at represent a rate of flow, as second-
ers' inches, and discharge in second-
ose that represent the actual quantity
n of inches, acre-feet, and millions of
ms used in this report are second-feet,
un-off in inches, and millions of cubic
s follows:
viation for "cubic feet per second."
ischarge of water flowing in a channel
foot wide and 1 foot deep at an average

velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (pp. 300–302).

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off (depth in inches)" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth of inches.

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

"Discharge relation," an abbreviation for the term "relation of gage height to discharge."

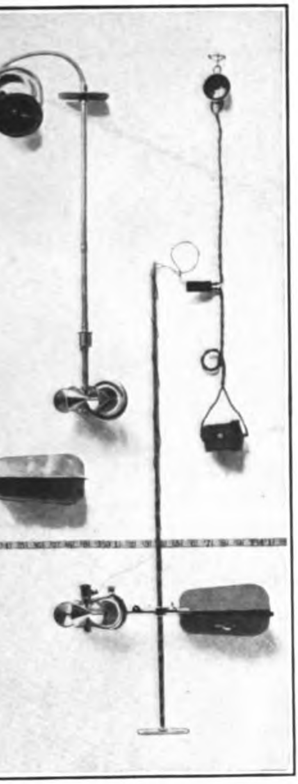
"Control," "controlling section," and "point of control," terms used to designate the section or sections of the stream below the gage which determine the discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

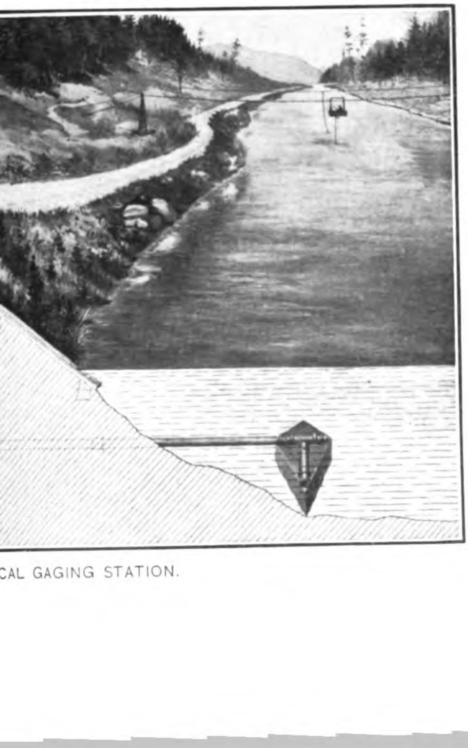
EXPLANATION OF DATA.

The data presented in this report are in general divided into periods beginning October 1 and ending September 30 of the following year. At the 1st of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during and after the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

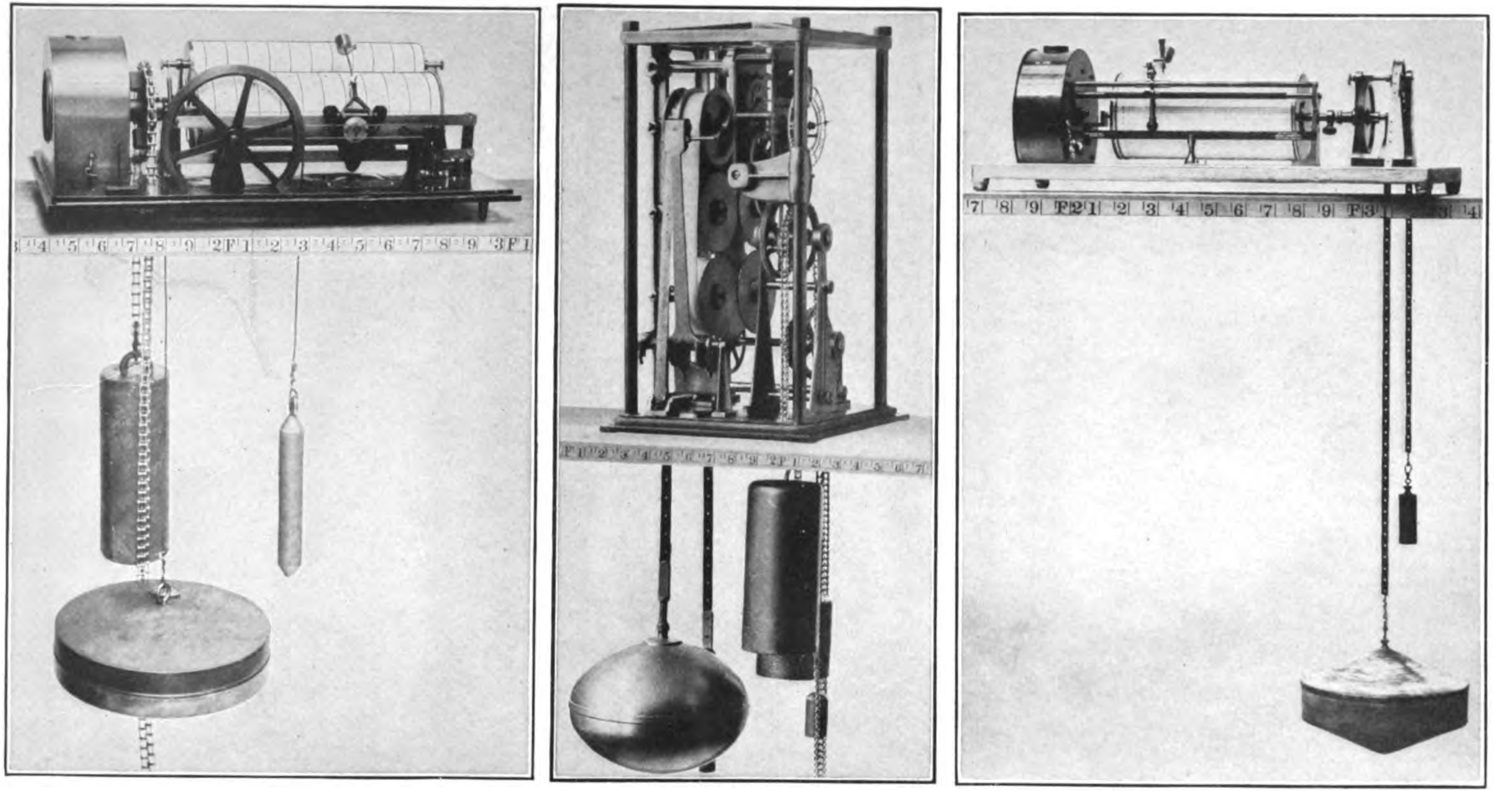
The base data collected at gaging stations (Pl. II, *B*) consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder (Pl. III) that gives a continuous record of the fluctuations. Measure-



CURRENT METERS.



CAL GAGING STATION.



A. STEVENS.

B. GURLEY PRINTING.

C. FRIEZ.

WATER-STAGE RECORDERS.

h a current meter (Pl. II, *A*) by the
dard textbooks on the measurement

ents rating tables are prepared that
and these rating tables, when applied
ischarge from which daily, monthly,
ermined.

aging station in the area covered by
of the station, a table giving results
able showing the daily discharge of
nly and yearly discharge and run-off.
nt to determine the daily discharge,
s and results of discharge measure-

on gives, in addition to statements
nt, information in regard to any con-
stancy of the discharge relation, cov-
rence of ice, the use of the stream for
, and the cause and effect of back-
n as to diversions that decrease the
gulation, maximum and minimum
cy of the records.

gives the discharge in second-feet
the gage heights read each day. At
sudden or rapid diurnal fluctuation
he rating table and the mean daily
rue mean discharge for the day. If
automatic gages the true mean daily
applying the rating table to gage
ls throughout the day.

arge the column headed "Maximum"
lay when the mean gage height was
is the mean for the day it does not
hen the water surface was at crest
ischarge was consequently larger than
n. Likewise, in the column headed
n is the mean flow for the day when
t. The column headed "Mean" is the
each second during the month. On
s recorded in the remaining columns,
-24, are based.

ted for some of the gaging stations
ach year on which the mean daily dis-
arge given in the table. By subtrac-

tion the table gives the number of days each year that the mean daily discharge was between the discharges given in the table and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given. For convenience the theoretical horsepower per foot of fall corresponding to the discharge is also given in the table. In using the table for studies of power, allowance should be made for the various losses, the most important being wheel loss and head loss.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends primarily (1) on the permanency of the discharge relation and (2) on the accuracy of observation of stage, measurements of flow, and interpretation of records.

Footnotes added to the daily discharge tables give information regarding the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables, "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The letter in the column headed "Accuracy", in the monthly discharge table, rates the accuracy of the monthly mean and not that of the estimate of maximum or minimum discharge or the discharge for any one day. The rating is determined by considering the accuracy of the rating curve, the probable reliability of the observer, the number of gage readings per day, the range of the fluctuation in stage, and local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of information concerning water diverted for various uses, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off (depth in inches)" are therefore not computed if such errors appear probable. All figures representing "second-feet per square

ches)" previously published by the
aution because of possible inherent
Survey.

rge gives only a general idea of the
ot be used for other than preliminary
ischarge allow more detailed studies
uld be borne in mind, however, that
ding year may be expected to throw
blished.

AFFECTING HYDROMETRIC
ASSACHUSETTS.

s on streams in Massachusetts water-
d necessary on account of the large
e to the operation of power plants.
is so completely regulated for power
gage readings a day are subject to
undred per cent. The type of fluc-
mpletely regulated power stream is
f Quaboag River at West Brimfield,
re a large diurnal fluctuation in stage,
h varies at different times, so that it
y coefficient to deduce the mean stage
Sundays and holidays, when the mills
ted by the changed appearance of the

a partly regulated stream are illus-
f Swift River at West Ware, Mass.
f the hydrograph and the amount of
conditions of operation of the power
s of operation, when the mean dis-
100 second-feet the regulation entirely
s of flow and would make two obser-
For a mean discharge of 200 second-
tion is slight, the peaks on the gage-
rly submerged. Above 300 second-
preciable effect from power operation.
ined without the use of a water-stage
classed as "good" for about three
or about four months, and decidedly
months. Any use of the data requir-
water flow would require continuous

Other types of fluctuation are illustrated by the hydrographs for Deerfield River at Charlemont, Mass. (fig. 3), and Westfield River near Westfield, Mass. (fig. 4). The hydrograph of the Westfield

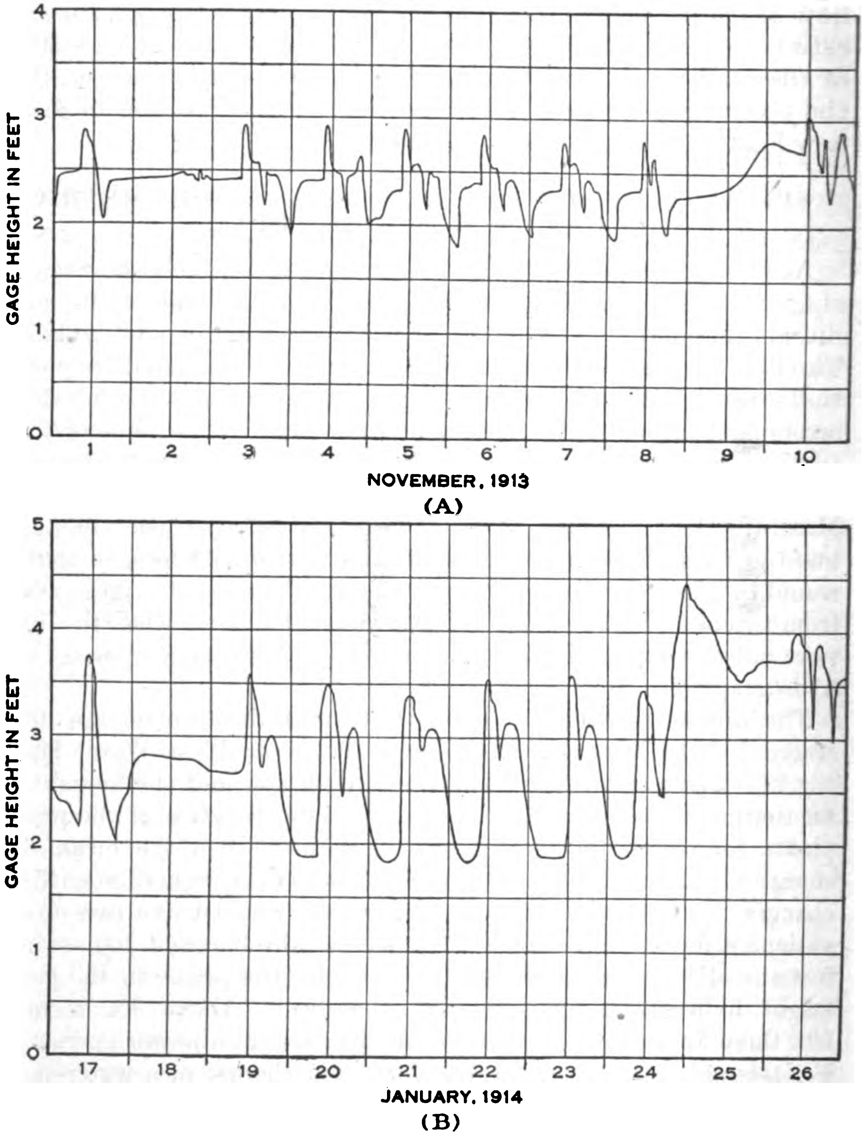
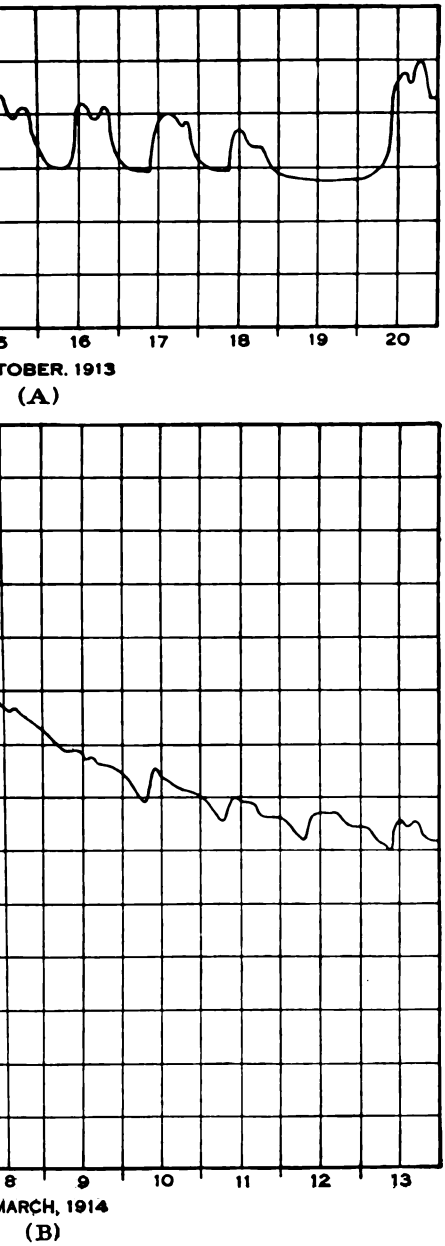


FIGURE 1.—Water-stage records of Quaboag River at West Brimfield, Mass.

shows a change in flow from 500 to 17,200 second-feet in 12 hours. The Westfield is not seriously affected by power regulation, but represents a class of streams having little natural storage and consequently a rapid run-off. Fluctuations due to rainfall are more

r causes, for the time of their occur-
dicted. The peak of the flood may



(A)

(B)

ds of Swift River at West Ware, Mass.

tion, and therefore missed entirely if
wo (or even more than two) observa-

A knowledge of the maximum flow and its duration may be all important in connection with flood prevention.

The water-stage recorders used in collecting the data presented in this report are of two general types. The instruments of one type give a continuous graphic record of gage-height changes; those of the other print in figures every 15 minutes the height of water on the gage. (See Pl. III.)

As might be expected, the difficulty of determining the flow of power-regulated streams does not end when the continuous record of stage is obtained, but calls for special office methods in interpreting the records, for, as the relation of the gage height to discharge would be represented by a curvilinear function, the sudden changes in stage require the application of the rating table at short intervals of time. On some of the streams it is necessary to apply the discharge rating in such a manner as to determine the discharge hourly throughout the year; on others two or four hour periods are used, and on streams affected less severely the discharge rating can be applied to the mean gage height for the 24-hour period. Various combinations of time intervals are used according to the stage and amount of fluctuation, and an effort is made to insure the highest degree of accuracy consistent with a rational expenditure of time and money.

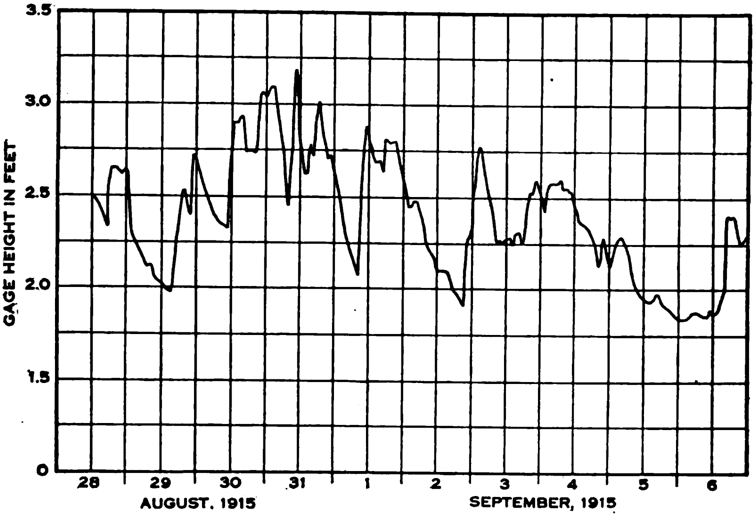
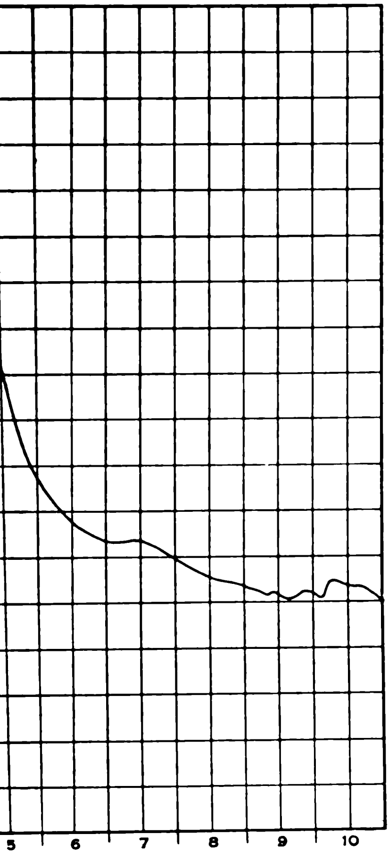


FIGURE 3.—Water-stage record of Deerfield River at Charlemont, Mass.

Another feature which complicates the collection of stream-flow data in Massachusetts is the low temperature during the winter months and its effect on the regimen of the streams. The gaging stations are so located that under conditions of open water a given

ight, represents a certain definite
age, the relation between the two
current-meter measurements taken
rmation of ice this known relation
me uncertain and unstable. Fairly
scharge of streams covered with or



of Westfield River near Westfield, Mass.

made if several current-meter meas-
ined and the gage-height record is
low are such that two gage-height
, the records may be obtained during
lty, although at greater expense on
arge measurements. For automatic-
rable difficulty is frequently encoun-
free from ice. Special construction

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w: U. S. Geol. Survey Water-Supply Paper 337, 1913.

becomes necessary and constant supervision is required to insure proper operation of the instruments. Plate X, *B* (p. 180), shows ice on Farmington River at New Boston, Mass., March 4, 1914. The peculiar conditions here illustrated were caused by the break-up of a small tributary that enters a quarter of a mile above the gage. The ice from the tributary, which has a steep gradient, piled up on the gaging section while the ice in the main stream below the gage was not carried out. Another peculiar condition is illustrated by Plate X, *A* (p. 180), which shows the effect of fluctuations in stage causing unstable conditions of the ice at the gaging section. The effects of the fluctuations in flow are also greatly increased during the winter period, as may be seen by referring to the hydrograph of Quaboag River at West Brimfield, Mass., for January, 1914 (fig. 1, B).

The special methods required to carry on stream gaging work successfully under the conditions of rapid fluctuation in stage and in a climate subject to the rigors of a northern winter are the outgrowth of years of experience by engineers of the Geological Survey.

GAGING STATIONS.

The following list comprises the gaging stations maintained in Massachusetts by the United States Geological Survey and cooperating parties. Two stations outside of Massachusetts are included in this list by reason of their value in connection with studies of streams within the State. Tributaries of main streams are indicated by indention. The date shows the years or parts of years for which records are available.

- **Housatonic River near Great Barrington, 1913–1915.**
- **Housatonic River at Falls Village, Conn., 1912–1915.**
- **Connecticut River at Orford, N. H., 1900–1915.**
- **Connecticut River at Sunderland, 1904–1915.**
- **Connecticut River at Holyoke, 1880–1899.**
  - **Millers River at Wendell Depot, 1909–1913.**
  - **Millers River at Erving, 1914–15.**
    - **Moss Brook at Wendell Depot, 1909–10.**
  - **Deerfield River at Hoosac Tunnel, 1909–1913.**
  - **Deerfield River at Shelburne Falls, 1907–1915.**
  - **Deerfield River at Charlemont, 1913–1915.**
  - **Deerfield River at Deerfield, 1904–1906.**
  - **Chicopee River:**
    - **Ware River at Ware, 1904–1911.**
    - **Ware River at Gibbs Crossing, 1912–1915.**
      - **Burnshirt River near Templeton, 1909.**
    - **Swift River at West Ware, 1910–1915.**
    - **Quaboag River at West Warren, 1904–1907.**
    - **Quaboag River at West Brimfield, 1909–1915.**
  - **Westfield River at Knightville, 1909–1915.**
  - **Westfield River at Russell, 1904–1906.**

–15.
er near Goss Heights, 1910–1915.
at Chester, 1915.
tfield, 1905–1915.
d, 1910–1915.
, 1913–1915.

.
1909–10.

7.
1866–1915.
5.

at Clinton, 1896–1915.
.
1875–1915.
ate, 1863–1915.

C RIVER BASIN.

L FEATURES.

Berkshire County, Mass., its head-
of Westfield River on the east, the
nderhook Creek on the west. The
nd near Washington Station, in the
urse is northward to Dalton. From
tward to Pittsfield, where it receives
hence its general course is southerly
enters near Stratford, Conn. It is
rainage area comprises 1,930 square
ve the Massachusetts State line is
square miles is in Massachusetts, 33
12 square miles in Connecticut. The
near Great Barrington is 280 square
Falls Village, Conn., 644 square miles.
eams rise at an altitude exceeding
At Pittsfield the elevation is about
e the river traverses a wide valley,
arms. In most places the bed of the
t in a few it is made up of ledges of
produce falls. The basin is to some
he headwater region, but as a whole
The basin includes about 15 square
e, and offers some opportunities for

Power has been developed at Housatonic, Great Barrington, and a number of other places in Massachusetts, but considerable power remains unutilized on the main river as well as its tributaries.

HOUSATONIC RIVER NEAR GREAT BARRINGTON, MASS.

Location.—At a highway bridge about a quarter of a mile northeast of the Van Deusenville railroad station and 2 miles north of Great Barrington.

Drainage area.—280 square miles.

Records available.—May 17, 1913, to September 30, 1915.

Gage.—Inclined staff on downstream side of left abutment of bridge; vertical high-water section attached to bridge abutment.

Discharge measurements.—Made from upstream side of bridge or by wading.

Channel and control.—Bed composed of sand and gravel; control practically permanent.

Extremes of discharge.—Maximum stage recorded: 7.9 feet, March 29, 1914; approximate discharge, 5,200 second-feet. Minimum stage: Zero flow at various times caused by storage of water above the mills.

Winter flow.—Discharge relation not seriously affected by ice.

Regulation.—Storage above dam of a paper mill about a mile above station causes low flow on Sundays and holidays.

Accuracy.—Records based on two gage readings a day and are considered fair.

Discharge measurements of Housatonic River near Great Barrington, Mass., during 1913–1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1913.		*Feet.*	*Sec.-ft.*	1914.		*Feet.*	*Sec.-ft.*
May 21	C. H. Pierce	2.19	409	Apr. 16	R. S. Barnes	3.96	1,590
Aug. 7	.....do	1.47	160	17	.....do	4.00	1,680
Oct. 18	R. S. Barnes	1.48	159	Aug. 16	O. W. Hartwell	1.19	80
19	.....do	.74	13.7	Sept. 27	R. S. Barnes	.66	12.4
				Dec. 17	.....do	1.46	151
1914.							
Mar. 3	R. S. Barnes	3.38	1,170	1915.			
3	C. H. Pierce	3.27	1,130	Feb. 2	R. S. Barnes	[a] 2.42	278
19	.....do	3.12	996	Apr. 9	.....do	2.38	512
20	.....do	2.88	837				

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Housatonic River near Great Barrington, Mass., for the years ending Sept. 30, 1913–1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1913.						1913.					
1	....	165	295	165	7	16	....	255	225	35	83
2	....	420	240	85	57	17	355	255	225	26	81
3	....	335	240	56	65	18	195	355	210	147	81
4	....	420	150	122	69	19	335	375	210	43	57
5	....	375	65	165	81	20	397	355	122	112	54
6	....	240	65	159	107	21	355	375	240	138	31
7	....	375	240	105	37	22	375	335	225	77	54
8	....	105	225	159	105	23	375	225	240	110	110
9	....	295	225	110	87	24	1,050	520	225	11	122
10	....	420	240	17	97	25	640	275	240	112	83
11	....	375	225	35	105	26	670	255	240	73	90
12	....	335	240	23	105	27	640	255	122	150	35
13	....	397	135	83	22	28	550	240	225	112	28
14	....	295	225	57	6	29	700	122	195	110	141
15	....	65	225	29	87	30	805	295	150	57	165
						31	770	....	150	9	....

nic River near Great Barrington, Mass., for
0, 1913–1915—Continued.

r.	Apr.	May.	June.	July.	Aug.	Sept.
470	2,060	1,260	335	225	85	125
670	2,560	1,190	335	210	122	138
980	3,460	840	255	195	97	165
805	2,830	805	255	122	195	165
050	2,650	910	295	56	195	195
910	1,500	1,660	275	105	141	56
770	1,420	1,500	255	295	110	130
670	1,740	1,190	255	295	17	195
470	3,550	1,050	275	255	51	150
610	4,300	840	255	355	34	165
550	3,920	735	295	295	75	138
495	2,470	910	335	165	165	195
445	2,300	1,500	141	180	165	56
355	2,060	1,500	150	225	180	240
355	1,820	1,420	195	225	141	165
355	1,740	1,260	195	240	97	195
335	2,830	770	225	225	110	138
670	1,660	875	225	165	153	195
,120	1,660	640	255	67	180	122
,120	2,300	640	85	255	165	32
640	3,370	640	255	180	195	85
315	3,100	610	335	225	355	165
445	2,470	495	355	180	122	138
470	1,500	375	210	150	335	162
520	1,500	295	195	141	240	162
910	1,500	445	240	17	180	105
,470	1,660	397	75	85	159	48
,580	1,660	550	165	130	240	112
,070	1,660	355	48	150	115	125
,920	1,420	210	240	180	22	110
,470	....	295	....	159	105	....

eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
420	520	375	420	195	180	159	445
470	980	275	355	195	255	165	470
295	735	130	295	240	315	295	335
315	580	275	397	122	420	315	255
335	580	255	420	110	255	1,340	153
700	495	375	355	13	420	1,190	110
520	420	520	315	141	375	1,120	355
580	420	520	420	122	1,050	770	240
580	580	470	335	105	4,110	69	315
445	470	397	315	97	3,370	520	275
375	335	1,050	397	81	2,060	520	240
375	420	2,140	355	69	1,420	420	180
315	445	2,060	315	85	1,190	315	225
335	375	1,740	225	97	980	315	225
580	315	980	295	130	700	375	195
,470	420	770	195	122	495	240	240
,740	397	640	195	75	470	375	225
,050	355	445	255	115	295	470	255
770	355	470	275	97	275	375	180
700	315	610	295	73	520	275	240
397	255	520	255	225	580	210	275
520	375	420	275	130	470	355	520
520	335	375	375	225	445	315	445
520	397	335	295	195	470	580	397
3,370	355	355	255	195	470	550	255
3,640	420	240	335	165	255	610	210
3,190	375	420	295	165	495	520	255
1,190	315	335	335	180	295	445	255
......	225	295	375	210	355	355	75
......	375	295	165	165	255	195	225
......	375	....	195	....	150	550	....

curve well defined below 1,700 second-feet. Discharge

Monthly discharge of Housatonic River near Great Barrington, Mass., for the years ending Sept. 30, 1913–1915.

[Drainage area, 280 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1913.						
May 17–31	1,050	195	547	1.95	1.09	B.
June	520	65	304	1.09	1.22	B.
July	295	65	203	.725	.84	B.
August	165	9	86.8	.310	.36	B.
September	165	6	75.1	.268	.30	B.
1913–14.						
October	1,580	22	273	.975	1.12	B.
November	1,190	54	403	1.44	1.61	B.
December	1,050	165	415	1.48	1.71	B.
January			[a] 255	.911	1.05	C.
February			[a] 279	.993	1.03	D.
March	5,070	315	1,130	4.04	4.66	C.
April	4,300	1,420	2,290	8.18	9.13	C.
May	1,660	210	844	3.01	3.47	B.
June	355	48	234	.835	.93	B.
July	355	17	186	.664	.77	B.
August	355	17	147	.525	.61	B.
September	240	32	139	.496	.55	B.
The year	5,070	17	549	1.96	26.64	
1914–15.						
October	165	1	80.9	.289	.33	B.
November	195	10	106	.379	.42	B.
December	195	17	112	.400	.46	C.
January	1,500	67	402	1.44	1.66	C.
February	3,640	295	954	3.41	3.55	C.
March	980	225	429	1.53	1.76	B.
April	2,140	130	603	2.15	2.40	B.
May	420	165	309	1.10	1.27	B.
June	240	13	138	.493	.55	B.
July	4,110	150	755	2.70	3.11	B.
August	1,340	69	462	1.65	1.90	B.
September	520	75	269	.961	1.07	B.
The year	3,640	1	382	1.36	18.48	

[a] Discharge for the month estimated on account of ice.

HOUSATONIC RIVER AT FALLS VILLAGE, CONN.

LOCATION.—About half a mile below the power plant of the Connecticut Power Co.; 23 miles north of Gaylordsville.

DRAINAGE AREA.—644 square miles (authority Stone & Webster Engineering Corporation).

RECORDS AVAILABLE.—July 11, 1912, to September 30, 1915.

GAGE.—Temporary staff gages July 11 to October 26, 1912; chain gage 1,500 feet below the railroad station October 27, 1912, to May 22, 1914; Stevens water-stage recorder 300 feet below chain gage, December 15, 1913, to September 30, 1915; all gage heights referred to datum of chain gage.

DISCHARGE MEASUREMENTS.—Made by wading at low stages, from a boat at medium stages, and by means of floats at flood stages.

CHANNEL AND CONTROL.—Channel deep and fairly uniform in cross section; one channel at all times; control not clearly defined except at low stages; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded: 13.3 feet at 4.30 p. m., March 29, 1914; discharge, 8,830 second-feet. Minimum stage recorded: Zero, at various times during the months of October, 1914, to January, 1915, owing to shutting down of power plant and storage of water.

WINTER FLOW.—Discharge relation not seriously affected by ice.

flow at low water was regulated by power 1914, the plant of the Connecticut Power Co. ater flow. The plant has a present capacity ad on the wheels of 90 feet.

by standard methods of stream-gaging and is

l by Connecticut Power Co.

iver at Falls Village, during years 1912–1914.

e.	Date.	Made by—	Gage height.	Discharge.
/.	1913.		*Feet.*	*Sec.-ft.*
58	July 8	D. M. Wood	1.60	254
55	9	.....do	1.44	205
30	9	.....do	1.55	235
70	Sept. 20	Jony and Magee	1.46	199
30	30	.....do	.94	82
80				
30	1914.			
	May 21	Wood and Jony	4.00	1,360
20				
67				

Staff gage.

onic River at Falls Village, Conn., for the years pt. 30, 1912–1915.

July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
			1912.			
383	803	430	21	329	450	304
334	637	304	22	231	374	250
338	545	329	23	288	338	200
440	392	182	24	255	555	234
266	324	214	25	228	370	378
324	347	228	26	214	206	273
262	262	329	27	196	307	182
262	316	374	28	145	206	189
388	276	256	29	160	276	214
284	430	242	30	175	245	234
			31	270	206	......

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,770	1,660	4,410	1,420	632	208	118	190
,660	1,330	3,660	1,270	700	196	133	190
,600	1,290	3,180	1,010	800	328	178	187
,320	1,320	2,880	860	800	294	187	205
,290	1,260	2,720	480	1,250	211	202	178
1,600	1,020	2,660	845	1,120	208	118	211
1,550	825	2,500	840	1,060	175	190	175
1,540	865	2,300	700	1,080	224	184	163
1,480	910	2,100	650	740	214	190	187
1,420	1,290	1,810	508	624	208	214	163
1,480	1,790	1,670	480	592	217	136	196
1,320	1,930	3,670	440	529	224	112	166
1,120	1,720	4,200	610	472	208	142	166
1,000	1,890	4,240	628	428	199	133	181
915	3,210	4,060	556	360	211	136	85
940	3,900	3,420	542	208	199	115	92
588	3,800	2,980	619	199	175	142	80
900	3,500	2,500	574	178	196	118	166
655	2,730	2,180	512	184	214	118	166
725	2,390	1,740	655	360	202	118	184
750	2,410	1,540	664	725	154	196	166
1,140	2,430	1,520	810	400	80	190	178
1,640	2,830	1,450	880	388	205	172	283
1,510	1,980	1,820	1,460	400	214	168	297
1,230	1,960	1,290	1,970	400	214	166	283

Daily discharge, in second-feet, of Housatonic River at Falls Village, Conn., for the years ending Sept. 30, 1912–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
26	2,690	725	1,200	2,150	1,290	2,430	1,250	1,600	332	109	166	208
27	2,360	1,170	1,370	2,110	825	3,930	1,050	1,150	336	139	80	190
28	1,420	1,040	1,450	2,080	1,690	6,960	1,070	1,030	272	139	175	214
29	1,160	1,060	1,440	1,400	....	8,110	1,610	1,710	283	115	196	208
30	1,000	1,100	1,470	1,290	....	7,160	1,510	1,650	220	148	202	72
31	725	....	1,810	1,690	....	5,520	....	1,240	....	154	166	....
1913–14.												
1	308	885	890	600	1,800	400	4,640	2,710	606	392	217	252
2	420	592	880	550	1,600	1,000	4,580	2,470	583	396	196	244
3	448	596	1,000	450	1,300	2,500	5,100	1,960	332	364	220	252
4	297	700	870	400	1,100	2,300	4,830	1,710	512	244	217	248
5	205	740	740	350	1,000	2,100	4,320	1,860	632	208	224	217
6	211	601	745	350	800	1,900	3,120	3,330	696	208	252	193
7	178	583	805	350	800	1,600	2,750	3,430	565	353	234	196
8	154	538	1,550	350	800	1,400	2,860	3,050	583	570	214	248
9	196	710	1,490	350	800	1,280	4,740	2,630	480	420	196	241
10	178	1,220	1,300	300	700	1,330	5,680	2,260	448	368	258	244
11	181	2,020	1,240	300	700	1,240	5,640	1,700	400	416	280	238
12	214	2,010	900	250	600	1,420	5,040	1,900	408	396	262	211
13	376	1,350	1,170	200	600	1,020	4,260	2,770	440	372	248	163
14	280	1,220	1,010	200	600	975	3,660	3,160	332	318	234	220
15	311	1,010	740	200	600	855	3,300	2,840	220	318	202	234
16	258	1,040	875	300	600	850	3,280	2,600	380	314	190	227
17	227	900	900	300	600	2,020	3,190	2,120	300	297	258	184
18	205	880	915	300	600	2,800	3,220	1,640	416	350	252	169
19	199	1,100	700	300	600	2,530	3,050	1,530	404	308	248	160
20	196	1,200	725	300	600	2,120	3,050	1,460	388	266	227	142
21	262	1,170	619	300	500	1,950	3,820	1,440	234	272	208	163
22	314	1,180	715	300	450	1,920	4,280	1,320	404	283	300	172
23	346	1,060	735	300	450	860	4,140	1,100	619	255	392	163
24	290	885	870	600	450	1,000	3,600	835	230	248	332	157
25	592	950	930	1,200	400	2,350	2,930	691	262	238	346	160
26	2,060	955	835	800	350	1,590	2,900	750	227	208	300	151
27	4,510	850	810	800	400	4,040	3,350	780	248	238	269	136
28	3,500	795	855	900	400	7,190	3,220	780	318	220	276	166
29	2,630	900	900	1,000	....	8,520	3,000	790	262	224	336	163
30	1,700	880	870	1,400	....	7,390	3,100	637	290	220	244	157
31	1,270	....	673	1,600	....	5,640	....	480	....	214	266	....
1914–15.												
1	160	90	139	45	1,050	2,760	542	855	336	339	529	1,090
2	169	109	154	70	1,500	2,020	484	820	346	504	583	765
3	151	109	151	35	1,360	1,640	488	682	325	715	664	780
4	139	118	142	135	1,150	1,320	432	673	356	865	1,210	686
5	163	136	112	140	1,060	1,340	556	740	318	845	3,220	614
6	166	133	95	145	1,340	1,140	632	765	241	830	3,320	516
7	166	100	115	950	2,320	1,040	915	650	311	910	2,720	500
8	169	98	136	2,240	1,950	920	1,090	740	308	1,080	2,170	504
9	157	112	157	1,680	1,490	935	1,030	920	314	3,390	1,610	583
10	160	118	118	1,270	1,240	955	1,020	715	280	4,480	1,460	588
11	133	98	130	760	960	920	1,340	705	224	4,390	1,330	460
12	154	88	139	950	840	725	2,740	664	187	3,540	1,230	368
13	148	87	106	2,090	870	735	3,120	610	154	2,630	1,170	448
14	59	73	148	2,000	860	730	2,810	534	234	1,990	895	444
15	24	29	145	1,240	1,460	664	2,240	460	266	1,580	830	420
16	37	154	151	765	3,830	601	1,620	464	255	1,280	850	460
17	60	139	151	668	3,960	691	1,390	436	241	980	1,020	476
18	92	136	151	1,700	3,140	646	1,230	476	297	960	1,060	538
19	121	136	124	2,690	2,200	592	990	504	356	835	910	400
20	121	127	100	2,660	1,490	588	1,070	500	529	1,360	845	516
21	136	139	151	2,040	1,170	538	1,000	456	512	1,220	632	642
22	121	124	148	1,290	965	538	830	700	452	1,400	1,010	1,020
23	121	157	130	965	1,040	547	875	678	420	1,230	1,730	1,080
24	98	148	125	1,650	1,330	512	795	668	560	1,080	1,740	975
25	88	145	109	1,420	3,760	592	740	596	420	935	1,450	686
26	112	112	86	1,190	5,850	642	637	547	416	730	1,440	350
27	112	115	98	1,000	4,800	655	686	614	276	745	1,260	730
28	115	115	138	810	3,740	601	720	601	350	850	1,040	583
29	112	100	136	655	....	606	673	476	336	850	960	460
30	112	160	141	696	....	606	730	432	339	850	1,060	456
31	112	....	130	583	....	601	....	356	....	840	975	....

NOTE.—Gage-height record lacking, and discharge estimated Sept. 22, Oct. 7–14, 1912, and July 28–30, 1915. Ice reported in river Feb. 7–23, 1913, Jan. 1 to Mar. 8, 1914, and Jan. 1–7, 1915.

Falls Village, Conn., for the years ending Sept. 1912–1915.

ea, 644 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).
Maximum.	Minimum.	Mean.	Per square mile.	
440	145	275	0.427	0.33
803	169	321	.498	.57
576	182	316	.491	.55
2,960	91	591	.918	1.06
2,800	632	1,180	1.83	2.04
1,990	845	1,410	2.19	2.52
3,020	1,290	2,300	3.57	4.12
1,770	588	1,250	1.94	2.02
8,110	825	2,700	4.19	4.83
4,410	1,050	2,420	3.76	4.20
1,970	440	915	1.42	1.64
1,250	178	536	.832	.93
328	80	193	.297	.34
214	80	157	.244	.28
297	72	181	.281	.31
8,110	72	1,150	1.79	24.29
4,510	154	726	1.13	1.30
2,020	538	984	1.53	1.71
1,550	619	912	1.42	1.64
1,600	200	513	.797	.92
1,800	350	721	1.12	1.17
8,520	400	2,390	3.71	4.28
5,680	2,750	3,820	5.95	6.64
3,430	480	1,830	2.84	3.27
696	220	407	.632	.71
570	208	306	.475	.55
392	190	255	.396	.46
252	136	196	.304	.34
8,520	136	1,090	1.69	22.99
169	24	122	.189	.22
160	29	117	.182	.20
157	86	131	.203	.23
2,690	35	1,110	1.72	1.98
5,850	840	2,030	3.15	3.28
2,760	512	884	1.37	1.58
3,120	432	1,110	1.72	1.92
920	356	614	.953	1.10
560	154	332	.516	.58
4,480	339	1,430	2.22	2.56
3,320	529	1,320	2.05	2.36
1,090	350	605	.939	1.05
5,850	24	810	1.26	17.06

Days of deficiency in discharge of Housatonic River at Falls Village, Conn., during the years ending Sept. 30, 1912–1915.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.			
		1912[a]	1912–13	1913–14	1914–15
100	11.4	....	7	....	20
150	17.0	1	37	2	78
200	22.7	13	83	27	100
250	28.4	30	111	76	104
300	34.1	46	120	101	109
350	39.8	60	124	127	119
400	45.4	67	127	145	125
450	51.1	73	132	161	135
500	56.8	76	135	168	148
600	68.2	80	143	178	177
700	79.5	81	154	199	209
800	90.9	82	166	216	230
900	102	....	182	241	250
1,000	114	....	189	252	270
1,500	170	....	255	287	323
2,000	227	....	299	304	335
2,500	284	....	328	315	344
3,000	341	....	347	328	351
4,000	454	....	357	347	361
5,000	568	....	361	357	364
6,000	682	....	362	362	365
7,000	795	....	363	362	....
8,000	909	....	364	364	....
9,000	1,020	....	365	365	....

[a] July 11 to Sept. 30, 1912.

NOTE.—The above table gives the theoretical horsepower per foot of fall that may be developed at different rates of discharge and shows the number of days on which the discharge and corresponding horsepower were, respectively, less than the amounts given in the columns for discharge and horsepower. In using this table allowance should be made for the various losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

CONNECTICUT RIVER BASIN.

GENERAL FEATURES.

Connecticut River rises in the Connecticut lakes in northern New Hampshire and flows southward between New Hampshire and Vermont and across Massachusetts and Connecticut into Long Island Sound. It is the largest river in New England except the St. John, is about 345 miles long, and drains an area of 11,300 square miles, which is distributed as follows:

	Square miles
Canada	105
New Hampshire	3,120
Vermont	3,970
Massachusetts	2,720
Connecticut	1,430

The river has many important tributaries, among which are Passumpsic, Ammonoosuc, Wells, White, Mascoma, Ottaqueechee, Sugar, West, and Ashuelot rivers, which join north of the Massachusetts line; Millers, Deerfield, Chicopee, and Westfield rivers, which enter in the State of Massachusetts; and Farmington River, which enters near Hartford, Conn.

onnecticut lakes to Long Island it 1,900 feet. The upper parts of most part forested, and the surface ch here and there rise to mountain n New Hampshire and Vermont the tributary streams have a good ltivation. Deerfield and Westfield n Massachusetts, are quick-spilling narrow valleys, largely wooded; he east, drain a flatter country in umerous. In Connecticut the river he country rolling, its soil is very ning district.

nite, gneiss, mica slate, and mica the red sandstone in the Connecti- aven nearly to the northern bound- vailing surface material is glacial

in the Connecticut Valley is about 45 inches at Hartford to probably upper portions. In a general way, month in the time of beginning of tion of the river and at its headwaters, everity of floods from melting snow The range in winter weather is also ourses of the river being frequently the upper third of the river usually winter. Snow accumulates to con- avigable to Hartford and, by smaller

ge on Connecticut River are perhaps England rivers, although on Millers, some storage has been developed. in this basin where reservoirs could of systematic effort in this direction onnecticut could be much improved ge sites, especially in the upper parts ributary to the Connecticut through in area and can be drawn down 60

ntaries are very important for water ge power plants are in operation at urners Falls, and Holyoke, but many nain undeveloped.

The longest record of flow in the Connecticut basin is that made at Holyoke, Mass., which extends back to 1880. This record was interrupted in 1899, but since 1904 the records of the station at Sunderland are available. The driest year during the period covered by these records was 1882–83, and the wettest 1889–90, the total flow during these two years being about in the ratio of 1 to 2.06.

The drainage areas of the river and of several of its tributaries are given in the following table:

Drainage areas of Connecticut River and tributaries.

River.	Locality.	Area.
		Sq. miles.
Connecticut	Mouth	11,400
Do	Hartford, Conn	10,600
Do	Holyoke, Mass	8,300
Do	Sunderland, Mass., at gaging station	8,000
Do	Orford, N. H., at gaging station	3,100
Passumpsic	Mouth	470
White	.....do	740
West	.....do	440
Ashuelot	.....do	440
Millers	.....do	394
Deerfield	.....do	667
Chicopee	.....do	721
Westfield	.....do	515

CONNECTICUT RIVER AT ORFORD, N. H.

Location.—At covered highway bridge between Orford, N. H., and Fairlee, Vt., approximately 10 miles downstream (by river) from mouth of Waits River.

Drainage area.—3,100[1] square miles.

Records available.—August 6, 1900, to September 30, 1915.

Gage.—Chain attached to upstream side of bridge and inclined staff on left bank below bridge.

Discharge measurements.—Open-water measurements made from downstream side of the bridge or from a cable.

Channel and control.—Channel wide and deep with gravelly bottom; control for low stages slightly shifting.

Extremes of discharge.—Maximum stage recorded, 1900–1915: 33.4 feet at noon, March 28, 1913 (see fig. 5, p. 56); approximate discharge, determined from extension of rating curve, 57,300 second-feet. Minimum discharge for 24 hours: 288 second-feet, September 28, 1908.

Winter flow.—Discharge relation seriously affected by ice, usually from December to March, but the relation remains unusually constant during each period.

Regulation.—A special study by means of temporary installation of a water-stage recorder during September and October, 1914, showed no appreciable effect from the operation of any power plants above the station.

Accuracy.—Rating curve fairly well defined and estimates during open-water periods considered good.

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[1] Remeasured since published in previous reports.

River at Orford, N. H., during 1900–1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
1907.			
Feb. 20	Butterfield and Mention	b 4.51	1,100
21	.....do	b 4.64	1,090
Sept. 27	D. M. Wood	5.87	3,710
1908.			
Mar. 4	D. M. Wood	b 7.11	2,340
Sept. 24	.....do	2.04	439
Dec. 24	Wood and French	b 3.53	698
1909.			
Feb. 9	H. F. French	b 8.90	4,140
July 19	D. M. Wood	4.48	1,800
Sept. 9	.....do	4.53	1,800
Oct. 26	.....do	5.18	2,340
Dec. 18	.....do	b 5.10	1,640
1910.			
Mar. 29	T. W. Norcross	15.38	17,000
Aug. 17	G. M. Brett	5.99	3,280
1911.			
Apr. 29	Covert and De Golyer	18.75	24,100
June 22	G. H. Canfield	4.82	2,280
1912.			
Feb. 21	G. H. Canfield	b 5.28	1,370
Oct. 22	C. S. De Golyer	5.31	2,550
1913.			
Mar. 10	C. S. De Golyer	b 5.52	1,420
Apr. 30	R. S. Barnes	11.65	10,900
Sept. 11	G. H. Canfield	2.47	604
1914.			
Jan. 5	W. S. Easterly	b 5.42	1,580
16	.....do	b 4.89	1,190
Feb. 4	.....do	b 6.44	1,940
23	C. C. Covert	b 5.22	1,060
Nov. 4	R. S. Barnes	4.85	2,120
Dec. 23	C. S. De Golyer	b 4.92	1,040
24	R. S. Barnes	b 4.80	1,040
1915.			
Jan. 15	R. S. Barnes	b 5.73	1,410
Feb. 9	.....do	b 6.80	1,600
25	.....do	b 13.0	9,190
26	.....do	23.52	34,500
Apr. 28	.....do	13.70	14,100
Sept. 17	Thweatt and Adams	4.16	1,390
17	G. F. Adams	4.05	1,440
18	.....do	3.82	1,330

ed.

by ice; gage read to water surface.

icut River at Orford, N. H., for the years ending
0, 1900–1915.

	Aug.	Sept.	Day.	Aug.	Sept.
			1900.		
	2,520	1,000	21	2,190	1,000
	2,610	950	22	1,880	1,100
	2,880	815	23	1,600	2,030
	3,270	950	24	1,460	2,520
	4,120	905	25	1,340	2,190
	5,110	1,000	26	1,340	1,880
	4,450	1,100	27	1,340	1,600
	3,900	1,100	28	950	1,400
	3,070	1,000	29	1,220	1,880
	2,700	1,000	30	1,160	2,350
			31	1,100	....

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1900–1901.												
1	2,790	2,190	6,380	5,500	2,400	1,800	12,300	15,500	7,600	8,450	6,140	1,100
2	4,010	2,110	6,140	5,000	2,400	1,800	11,000	16,300	6,900	6,640	5,660	1,600
3	3,790	2,030	5,660	4,500	2,300	1,800	12,300	15,500	5,900	3,680	3,900	1,740
4	2,700	1,880	5,330	4,000	2,300	1,800	17,400	13,300	6,140	5,000	3,470	1,740
5	2,350	1,600	5,110	3,600	2,300	1,800	22,100	11,000	6,640	5,220	3,170	1,600
6	1,880	1,600	5,000	3,300	2,000	2,000	21,700	9,320	6,640	5,900	3,070	1,400
7	2,700	1,950	5,110	3,000	2,000	2,000	24,200	8,020	6,380	4,340	2,790	1,400
8	3,680	3,470	5,110	2,800	2,500	2,000	29,700	7,460	5,440	4,230	3,680	1,400
9	3,270	10,100	5,110	2,800	2,500	2,000	31,900	7,040	6,140	4,010	4,450	1,880
10	3,680	13,700	5,550	2,800	2,500	2,500	31,000	7,040	6,260	4,340	5,780	1,460
11	4,780	13,700	5,110	2,700	2,400	2,500	28,400	7,460	5,900	4,120	6,640	1,400
12	12,000	12,000	5,110	2,700	2,400	2,500	25,400	8,020	5,660	4,010	6,510	1,340
13	12,600	8,880	5,220	2,700	2,400	2,500	22,900	8,300	5,330	4,010	6,380	1,460
14	9,180	7,740	5,110	2,700	2,400	2,500	21,300	8,300	4,560	3,170	5,220	1,600
15	6,770	6,140	4,780	2,700	2,300	2,500	21,300	7,740	4,010	2,190	4,230	1,740
16	5,900	5,660	4,230	2,600	2,300	2,500	21,700	6,380	3,680	1,810	3,570	2,030
17	5,660	4,450	4,120	2,600	2,300	3,000	22,100	5,550	3,470	1,740	4,340	1,600
18	5,220	3,680	4,010	2,600	2,200	3,000	22,500	5,660	3,270	1,670	4,340	1,530
19	4,780	4,010	4,010	2,600	2,200	3,000	23,400	6,900	2,790	2,520	4,120	1,670
20	4,340	5,660	4,120	2,600	2,200	3,000	24,200	9,180	2,700	2,520	3,900	1,810
21	4,010	10,200	4,230	2,500	2,100	3,000	24,200	11,600	2,610	2,520	3,900	1,810
22	3,680	14,600	4,010	2,500	2,100	3,000	25,900	8,300	4,340	2,270	2,700	1,880
23	3,070	16,300	4,230	2,500	2,000	3,300	29,700	7,740	5,000	1,950	2,520	2,110
24	3,270	15,300	4,450	2,500	2,000	5,000	32,300	7,600	6,510	1,740	2,350	1,880
25	3,070	12,500	5,550	2,500	2,000	9,320	32,600	9,180	6,900	1,670	2,270	1,460
26	3,270	9,770	6,900	2,500	2,000	10,800	29,700	9,470	6,020	1,400	2,190	1,400
27	3,170	10,100	6,640	2,400	1,900	15,900	24,600	8,020	4,780	1,280	1,810	1,280
28	2,880	10,400	6,260	2,400	1,900	21,300	19,700	7,600	3,790	1,460	1,600	1,280
29	2,880	8,300	5,900	2,400	....	19,500	16,600	8,300	4,340	1,880	1,400	1,220
30	2,520	6,770	5,900	2,400	....	16,100	14,800	9,180	7,600	2,430	1,340	1,670
31	2,350	....	5,900	2,400	....	13,700	....	9,030	....	5,000	1,100	......

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1901–2.												
1	1,340	1,670	1,460	5,000	2,700	12,100	23,200	16,800	17,000	6,020	2,190	2,110
2	1,340	1,670	1,530	6,000	2,600	27,400	21,700	16,400	11,500	5,780	4,890	2,030
3	1,400	1,600	1,600	6,000	2,600	43,400	18,200	16,600	9,320	6,260	6,510	2,110
4	1,400	2,030	1,500	6,000	2,600	38,800	14,400	15,000	11,600	6,770	7,460	2,110
5	1,460	1,460	1,500	6,000	2,500	35,000	11,300	14,800	12,300	5,660	6,140	2,270
6	1,670	1,340	1,500	5,500	2,500	29,300	10,800	9,470	11,200	5,330	5,000	2,270
7	1,880	1,340	1,500	5,000	2,500	21,900	10,100	9,320	10,800	4,670	4,780	2,110
8	1,740	1,280	1,500	5,000	2,500	18,700	9,620	8,300	10,500	4,560	4,670	2,430
9	1,530	1,340	1,500	4,500	2,500	18,500	9,320	7,320	9,770	4,340	4,560	2,880
10	1,530	1,400	2,500	4,000	2,500	18,500	10,200	7,040	12,500	4,340	4,780	3,790
11	1,460	1,740	3,000	3,800	2,400	19,100	12,600	7,040	11,500	4,120	4,560	4,670
12	1,460	1,600	4,560	3,700	2,400	19,300	13,000	6,260	10,200	3,470	5,780	5,330
13	1,400	1,340	5,220	3,600	2,400	20,300	14,200	5,780	9,030	3,170	8,300	5,220
14	1,860	1,740	5,660	3,500	2,300	19,300	13,000	5,000	7,740	3,070	6,380	5,000
15	2,190	2,030	13,000	3,400	2,300	18,700	12,600	5,330	7,460	2,880	4,780	4,560
16	4,670	2,030	30,400	3,300	2,200	18,500	11,300	5,550	7,180	3,470	4,560	4,230
17	5,220	2,110	28,400	3,200	2,200	18,500	8,600	5,220	11,300	3,790	4,230	4,120
18	3,470	2,350	20,300	3,100	2,200	18,700	8,880	4,890	14,600	3,790	3,680	4,010
19	3,370	2,190	16,100	3,100	2,100	18,500	9,320	4,560	15,300	3,900	3,070	2,700
20	3,070	1,810	8,600	3,100	2,100	18,900	9,320	4,670	10,400	3,900	2,700	2,520
21	2,970	1,670	6,140	3,000	2,100	18,900	9,620	4,560	6,900	4,010	2,430	4,340
22	2,790	1,400	6,640	3,000	2,000	19,100	11,600	4,780	6,640	4,450	2,350	5,220
23	2,610	1,400	7,180	3,000	2,000	19,100	12,100	4,670	6,140	4,890	3,070	4,560
24	2,430	1,530	6,000	3,000	3,000	18,500	12,300	5,550	5,550	4,670	4,230	4,120
25	2,270	1,950	5,000	2,800	5,000	18,400	12,600	6,140	5,110	4,560	4,560	2,970
26	2,110	2,030	4,500	2,800	8,000	16,800	13,700	8,160	4,890	4,340	5,550	3,070
27	2,430	2,110	4,000	2,800	5,660	14,800	16,300	12,000	6,900	3,900	5,220	3,170
28	2,520	1,950	3,800	2,700	2,880	11,600	16,400	29,500	8,450	3,370	2,790	3,070
29	2,350	1,530	3,500	2,700	....	9,770	16,600	31,900	8,300	3,070	2,350	3,070
30	1,950	1,530	3,500	2,700	....	14,400	16,400	26,700	7,600	2,790	2,270	2,970
31	1,740	....	3,000	2,700	....	21,700	....	20,500	....	2,520	2,270	......

ut River at Orford, N. H., for the years ending 915—Continued.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
3,200	18,500	5,660	1,740	2,030	2,610	2,030
7,800	16,600	5,780	1,400	2,030	3,470	1,950
7,400	13,900	5,660	1,280	2,190	2,970	1,950
6,100	14,400	5,000	1,280	2,430	2,110	1,880
4,800	22,900	4,670	1,160	2,520	1,880	1,880
13,800	18,900	4,340	1,100	2,190	1,600	1,880
12,000	16,100	4,010	1,220	1,950	1,600	1,740
11,500	14,000	4,010	1,340	1,810	1,530	1,340
17,600	15,500	4,120	1,400	1,530	1,530	1,160
24,800	15,500	4,340	1,600	1,400	1,530	1,100
31,900	15,200	4,450	1,460	1,530	1,670	1,000
33,400	13,900	4,560	2,190	2,110	2,110	1,000
33,000	12,300	4,340	4,780	2,520	2,110	1,000
29,300	10,700	3,470	7,740	2,110	2,030	950
27,400	10,500	3,680	7,740	1,670	1,950	950
26,300	10,200	3,270	5,660	1,400	1,880	860
25,000	10,400	3,270	4,120	1,460	2,110	770
22,100	8,880	3,270	3,170	2,110	1,810	725
19,500	8,160	2,880	2,790	2,970	1,340	770
21,500	8,020	2,520	2,790	2,970	1,280	770
28,200	7,180	2,520	3,070	2,350	1,460	815
33,700	6,380	2,430	3,370	2,350	2,270	770
37,800	6,140	1,950	6,260	2,350	3,270	725
40,100	5,550	2,110	5,660	2,430	3,170	680
39,900	5,550	2,030	4,670	2,520	2,970	640
37,000	5,550	1,740	3,470	2,430	2,610	680
32,100	5,440	1,600	3,270	3,370	2,350	680
25,900	5,330	1,530	2,520	4,010	2,430	725
19,900	5,110	1,530	2,190	3,470	2,190	725
16,100	5,110	1,460	2,190	2,880	1,950	770
13,900	....	1,460	....	2,610	2,030	....
1,160	14,600	22,500	4,780	1,810	1,530	1,400
1,160	13,700	22,900	4,340	1,740	1,600	1,280
1,160	13,300	21,300	4,120	1,740	1,600	1,340
1,160	11,200	20,900	3,570	1,880	1,460	1,340
1,220	8,880	19,700	3,470	2,350	1,400	2,270
1,400	8,160	16,800	3,470	2,270	1,340	3,900
1,400	9,470	15,700	3,790	1,950	1,160	3,790
1,470	10,400	13,300	5,000	1,670	1,050	2,970
3,360	14,000	11,300	6,260	1,530	905	2,700
3,670	18,900	11,300	5,780	1,400	1,000	2,350
3,010	21,700	11,600	4,670	1,460	1,340	1,740
2,590	20,900	14,600	3,900	1,000	1,340	1,740
2,240	18,200	13,200	3,270	1,050	1,460	1,400
2,030	14,800	10,100	2,880	1,340	1,600	1,400
1,960	10,700	8,740	2,610	1,670	1,670	1,740
1,820	8,450	14,800	2,270	1,740	1,600	5,110
1,680	7,460	18,900	2,190	1,670	1,740	5,660
1,750	7,740	19,500	2,190	1,670	1,530	5,000
1,610	7,460	23,600	2,110	1,160	1,460	4,450
1,540	6,640	22,900	2,110	1,100	1,600	4,010
1,540	6,640	22,300	2,030	1,000	2,350	3,900
1,680	6,900	16,800	1,530	950	3,900	5,220
1,890	7,320	13,000	1,670	950	4,780	5,900
8,840	9,030	10,400	1,740	815	4,340	4,670
8,840	11,000	8,740	1,810	860	4,120	4,450
10,400	16,300	8,300	1,740	905	3,470	5,660
17,200	17,800	7,600	1,810	905	2,700	7,460
18,600	18,500	7,040	1,400	1,100	2,350	6,510
21,700	21,500	6,770	1,950	1,340	2,030	5,330
18,500	22,100	6,640	1,810	1,400	1,600	6,140
15,900	....	6,260	....	1,460	1,280	....

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1904–05.												
1	8,880	3,790	2,110	880	700	580	33,200	12,600	4,450	6,510	3,680	6,640
2	10,800	3,570	1,970	800	700	580	31,000	12,100	4,230	7,040	5,000	5,440
3	10,500	3,570	1,830	800	700	560	23,400	9,620	3,680	10,400	7,320	4,120
4	9,920	3,370	1,970	800	600	560	15,200	10,100	3,790	17,600	5,330	6,510
5	9,180	3,270	1,830	800	600	560	11,300	12,000	4,010	15,200	4,340	7,740
6	7,320	3,270	1,630	800	620	600	11,000	12,600	4,120	9,920	3,070	7,180
7	5,220	3,070	1,510	800	640	600	13,300	13,000	5,220	4,780	2,610	6,140
8	5,000	2,970	1,460	720	660	600	13,000	12,600	4,560	3,900	2,610	5,440
9	4,560	2,880	1,350	770	660	600	12,000	11,800	4,340	3,470	3,070	4,670
10	4,230	2,520	1,240	820	680	600	9,770	10,100	3,680	3,270	3,370	4,010
11	4,230	2,350	1,130	870	700	600	10,200	10,700	3,270	2,970	2,610	3,270
12	4,010	2,190	1,050	920	720	600	12,500	10,200	2,880	2,700	2,790	2,970
13	4,560	2,030	1,050	970	730	670	13,500	8,300	3,470	2,790	2,430	3,170
14	4,230	2,430	1,050	1,020	740	800	13,300	7,880	5,220	2,700	2,520	3,070
15	4,120	2,350	1,050	1,070	740	850	13,000	7,600	5,780	2,520	2,610	2,880
16	4,120	2,350	1,050	1,000	740	910	12,300	7,180	5,000	2,610	3,370	2,610
17	3,900	1,970	1,050	1,000	740	1,000	10,700	6,900	4,560	2,700	6,020	2,520
18	3,680	1,970	970	975	740	1,100	9,180	7,180	3,170	2,610	6,140	4,120
19	3,370	1,830	950	975	760	1,180	7,740	7,040	3,270	2,610	5,110	9,180
20	3,270	1,750	950	950	740	2,070	7,040	6,900	3,570	3,900	3,900	10,400
21	3,270	2,270	950	950	720	3,060	11,000	6,900	3,370	4,010	3,070	10,400
22	5,220	2,320	940	880	680	3,480	14,000	6,770	3,470	3,570	2,610	9,770
23	6,640	2,480	940	880	680	3,620	15,200	6,380	3,470	2,520	2,350	8,020
24	6,380	2,590	940	880	660	3,730	13,700	5,660	3,370	2,190	2,030	6,140
25	5,660	2,670	920	840	620	5,300	11,300	5,000	2,970	1,950	1,670	5,660
26	5,550	2,590	900	840	600	19,300	9,770	4,670	2,610	1,670	1,460	4,560
27	5,330	2,270	900	800	600	24,600	9,620	4,120	3,370	1,670	1,460	4,450
28	5,000	2,190	900	800	600	31,900	10,500	6,510	7,180	1,600	2,190	4,010
29	5,000	2,110	900	800	....	37,200	11,600	7,040	7,460	1,600	3,680	3,680
30	4,560	2,110	900	800	....	37,200	12,600	6,140	5,900	1,530	3,370	3,470
31	4,450	....	900	700	....	35,400	....	4,670	....	3,470	4,450	......

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1905–6.												
1	3,270	2,030	6,210	5,660	8,020	2,500	5,200	7,320	14,600	4,010	2,970	2,110
2	3,170	2,110	7,600	6,000	6,510	2,200	5,000	8,160	11,800	4,010	2,970	1,670
3	2,880	2,030	8,650	6,500	4,310	2,100	5,000	12,000	9,180	3,790	2,970	1,880
4	2,880	2,110	9,360	6,000	4,000	2,100	4,000	14,600	7,320	3,370	2,110	3,570
5	2,700	2,270	10,200	5,000	3,500	2,000	4,000	14,200	8,160	3,570	1,670	3,270
6	2,610	3,070	10,100	4,000	3,000	2,000	4,000	13,000	8,020	3,680	1,950	2,970
7	2,520	3,570	9,770	3,000	2,500	2,000	4,000	12,600	9,320	3,370	1,530	2,430
8	2,350	4,010	9,470	3,000	2,250	2,000	4,000	12,100	10,400	2,970	1,460	2,110
9	2,270	3,790	8,600	2,500	2,250	2,000	4,000	10,700	11,800	2,880	1,670	1,950
10	2,190	3,680	6,140	2,500	2,250	1,800	4,000	13,500	11,200	2,430	1,670	1,950
11	2,110	3,470	5,440	2,500	2,250	1,800	4,000	15,000	9,470	2,970	1,460	1,460
12	2,110	3,370	4,120	2,000	2,250	1,800	3,000	14,200	7,460	2,970	1,160	1,670
13	2,880	3,070	4,010	2,000	2,250	1,800	3,000	13,200	6,770	3,070	1,400	1,740
14	3,170	3,070	3,900	2,000	2,250	1,700	3,000	18,000	6,260	2,610	1,160	1,400
15	3,170	2,970	3,900	2,000	2,250	1,500	10,000	18,900	5,550	2,430	1,220	1,340
16	2,970	2,790	3,900	2,000	2,150	1,600	29,700	17,400	5,000	2,520	1,050	1,280
17	2,700	2,970	4,120	2,000	2,050	1,600	30,200	19,300	4,340	2,110	1,100	1,400
18	2,430	3,070	3,570	2,000	2,200	1,600	29,700	19,700	3,900	1,950	1,160	1,280
19	2,430	2,880	3,070	2,000	2,500	1,600	27,100	14,200	3,570	1,740	1,220	1,220
20	2,520	2,970	3,270	2,000	2,500	1,600	24,800	13,200	3,270	1,740	1,340	1,100
21	2,790	3,070	3,570	2,500	2,500	1,600	23,400	11,800	3,680	1,670	1,050	950
22	3,070	3,170	4,120	4,000	2,500	1,600	24,000	10,200	4,010	2,110	1,100	1,000
23	2,970	3,370	4,560	5,000	2,500	1,600	22,300	8,450	4,450	2,610	1,050	950
24	3,070	2,790	4,670	21,900	2,850	1,500	17,400	8,020	4,780	2,350	1,100	1,050
25	2,880	2,430	4,560	27,100	3,500	1,500	14,200	7,460	4,450	2,030	1,050	1,100
26	2,520	2,610	4,560	24,600	3,500	1,800	10,700	11,300	4,230	1,740	1,280	1,050
27	2,190	2,880	4,450	21,300	3,250	1,800	9,620	13,300	3,900	2,110	2,110	1,000
28	2,190	2,970	4,340	16,400	3,000	2,000	9,030	23,800	3,680	2,110	4,010	1,000
29	2,190	3,680	4,560	12,500	....	5,000	8,160	27,600	3,370	1,740	3,470	1,050
30	2,190	5,200	4,670	10,100	....	6,400	7,460	20,300	3,470	2,190	3,370	1,000
31	1,880	....	6,140	8,880	....	6,600	....	18,200	....	2,700	2,520	......

River at Orford, N. H., for the years ending *15*—Continued.

ar.	Apr.	May.	June.	July.	Aug.	Sept.
,360	21,900	35,400	5,320	6,900	4,600	1,340
,340	16,600	39,000	5,450	9,770	6,100	1,400
,320	15,000	40,600	4,720	9,320	6,230	1,400
,320	13,000	36,300	4,600	9,470	5,580	1,400
,320	12,000	30,200	4,840	8,300	4,960	1,950
,320	13,000	24,200	4,960	7,460	4,600	4,260
,320	12,100	19,100	5,200	5,450	4,380	5,080
,320	11,600	17,600	5,080	4,600	4,030	3,920
,320	9,770	14,000	4,840	4,490	3,590	3,380
,320	8,880	15,500	4,960	4,260	3,280	2,790
,310	8,740	16,100	4,260	4,260	2,880	3,280
,300	8,600	15,900	4,030	4,030	2,700	2,430
1,290	8,020	14,200	3,810	4,380	2,430	3,700
1,290	8,300	11,600	3,810	4,600	2,190	4,840
1,270	8,740	12,500	3,170	4,720	2,110	4,960
1,260	8,740	12,600	2,790	5,450	1,950	3,280
1,240	8,020	14,400	2,610	3,920	1,740	2,970
1,600	8,600	16,400	2,520	3,170	1,460	2,520
1,600	8,020	16,600	2,790	2,880	1,400	2,110
1,800	7,600	13,500	3,170	2,520	1,280	2,610
2,050	7,320	11,500	8,600	2,430	1,280	2,030
2,300	7,460	9,620	10,100	2,270	1,220	1,530
2,500	8,300	8,160	8,450	2,350	1,220	1,530
2,700	13,000	7,600	5,080	2,520	1,220	2,190
3,800	24,800	6,230	4,380	2,700	1,160	2,880
4,500	25,200	5,840	3,810	2,520	1,160	3,810
6,000	31,200	6,230	3,590	2,700	1,100	3,380
0,000	31,700	5,960	3,480	2,970	1,100	2,970
5,000	32,300	6,100	4,600	3,380	1,050	3,070
0,000	32,600	5,840	5,580	4,260	1,280	7,180
7,000	....	5,320	....	4,490	1,340	....

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
2,790	16,400	35,400	6,230	1,810	1,200	780
2,770	13,500	31,200	10,800	1,740	1,200	980
2,560	11,000	23,800	8,160	1,740	1,200	830
2,340	8,880	20,900	6,900	1,970	880	830
2,300	6,900	18,200	6,360	1,890	1,200	980
2,260	7,040	15,000	5,080	1,740	1,200	880
2,260	7,880	13,300	4,260	1,660	3,810	730
2,260	10,100	12,000	3,810	1,590	3,590	640
2,200	9,920	13,200	3,170	1,660	3,480	780
2,200	9,320	15,200	2,870	1,590	2,680	550
2,500	10,400	18,200	2,780	1,460	2,220	595
3,000	13,000	16,300	2,780	1,320	1,890	640
3,600	12,300	14,200	2,680	1,090	1,660	685
4,500	11,200	15,000	2,400	980	1,590	528
5,500	10,400	15,300	2,220	1,140	1,520	550
6,600	10,700	13,200	5,320	1,260	1,460	640
6,000	10,800	10,700	8,300	1,260	1,460	550
5,500	10,200	8,600	11,500	1,320	1,520	595
5,300	9,620	8,160	8,160	1,390	1,660	595
5,000	9,470	8,160	5,700	1,660	2,050	505
4,700	9,180	7,880	4,260	2,310	2,050	385
4,500	9,320	6,900	8,170	2,220	1,890	595
4,300	9,470	6,640	2,780	2,050	1,660	505
6,900	9,920	6,230	2,680	1,740	1,460	425
10,000	11,000	5,700	2,220	1,590	1,200	550
14,000	14,000	5,200	2,050	1,390	1,260	595
18,000	19,700	5,450	1,890	1,200	1,200	465
23,400	22,100	5,700	1,740	1,140	1,200	288
26,500	34,900	5,580	1,660	1,200	1,090	550
30,600	36,700	6,230	1,520	1,260	880	595
20,700	....	5,960	....	1,200	880	....

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—**Continued.**

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1908–9.												
1	550	640	2,050	1,030	2,840	5,740	7,000	13,000	7,320	1,520	880	880
2	640	685	1,890	1,030	2,780	4,980	8,200	12,600	6,500	1,660	880	1,040
3	730	730	1,810	1,020	2,740	4,560	9,920	11,800	5,700	1,660	780	880
4	880	830	1,740	1,330	2,710	4,150	11,600	11,600	4,960	1,590	730	930
5	780	780	1,740	1,640	2,740	3,920	14,400	12,300	4,490	1,460	780	930
6	1,040	640	980	3,820	2,760	3,690	18,500	12,800	5,320	1,810	780	1,040
7	980	685	1,140	6,000	2,800	3,640	22,300	12,800	6,100	2,400	880	1,260
8	980	730	1,390	5,720	2,830	3,590	29,100	15,200	5,580	2,220	830	1,590
9	880	685	1,590	4,850	4,140	3,520	29,900	16,400	4,840	1,970	880	1,810
10	730	730	1,390	4,480	3,990	3,240	24,400	17,800	4,140	1,590	640	1,660
11	730	730	1,260	4,100	3,830	3,150	24,000	19,900	3,480	1,740	780	1,590
12	640	780	1,200	3,570	3,670	3,060	23,800	23,200	3,280	1,520	640	1,390
13	730	1,040	1,260	3,000	3,360	3,160	22,700	21,700	3,170	1,320	685	1,260
14	830	1,200	1,390	2,430	3,040	3,260	24,400	20,300	2,870	1,320	730	1,460
15	930	1,260	1,390	2,270	2,810	3,150	42,000	17,000	3,480	1,140	685	1,460
16	980	1,260	1,240	2,100	2,580	3,040	49,700	16,800	3,170	1,140	780	1,390
17	880	1,320	1,120	1,900	2,410	2,980	49,600	18,000	3,070	1,140	730	1,260
18	830	1,260	1,000	1,690	2,240	2,920	46,800	18,900	4,140	1,460	730	1,090
19	685	780	1,000	1,660	2,170	2,860	42,200	19,900	3,810	1,970	685	1,140
20	595	980	1,040	1,640	2,100	2,800	38,800	19,100	4,030	1,740	730	1,200
21	595	930	1,000	1,700	5,000	2,720	38,100	16,800	3,810	1,660	830	1,140
22	640	880	950	1,770	7,120	2,630	35,000	16,100	3,380	1,590	880	1,200
23	595	780	800	1,940	6,110	2,480	30,600	11,200	3,170	1,460	980	1,200
24	640	830	698	2,010	7,120	2,320	26,100	10,700	3,280	1,390	1,090	1,140
25	640	930	780	2,010	7,310	3,000	20,700	8,450	3,070	1,260	1,090	1,320
26	595	1,040	860	2,010	7,320	3,680	17,400	8,020	3,070	1,460	1,040	1,260
27	685	1,320	860	3,440	6,910	4,430	15,200	7,320	2,050	1,140	930	1,200
28	595	1,740	860	3,500	6,500	5,200	13,300	6,770	1,970	1,090	880	1,260
29	730	2,780	870	3,570	....	5,400	13,700	8,740	1,740	980	930	3,380
30	730	2,140	890	3,230	....	5,800	13,500	11,600	1,590	930	1,040	5,450
31	685	....	950	2,890	....	6,300	....	9,620	....	930	980	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	6,100	1,660	3,700	1,000	4,000	8,000	23,600	9,920	8,740	2,520	2,000	1,000
2	6,360	1,740	4,030	1,000	3,500	15,200	24,500	10,200	8,880	2.340	1,690	1,000
3	3,280	1,740	3,920	1,000	3,500	21,500	24,200	10,100	11,300	2,080	1,620	1,000
4	3,280	1,810	3,700	900	3,000	20,300	21,000	9,920	14,800	1,920	2,040	1,110
5	3,920	1,970	3,380	900	2,500	17,800	18,400	9,770	8,450	1,920	6,230	1,000
6	3,700	2,140	2,780	900	2,000	18,000	16,600	15,700	7,320	1,840	5,960	2,170
7	3,590	2,580	2,580	900	2,000	19,100	20,200	13,700	7,320	2,170	4,260	3,090
8	2,400	2,220	2,490	900	2,000	17,000	23,200	9,920	7,180	1,840	3,400	2,800
9	2,220	2,220	2,310	1,000	2,000	15,500	23,300	9,920	8,300	1,550	2,520	2,700
10	1,810	2,050	2,400	1,000	1,500	13,300	21,700	8,600	7,880	1,550	2,430	2,080
11	1,460	2,220	2,220	1,000	1,500	11,300	17,200	9,470	7,460	1,290	2,340	2,000
12	1,590	2,490	2,140	1,000	1,500	9,770	12,800	9,030	6,900	1,620	2,260	2,000
13	1,460	2,310	2,050	1,000	1,500	9,470	10,500	8,020	6,640	1,480	2,080	1.920
14	1,460	2,220	1,970	900	1,500	8,740	9,030	7,040	6,100	1,690	2,000	1,760
15	1,460	2,140	1,990	900	1,500	8,300	7,740	7,360	5,320	2,430	1,840	2,260
16	1,520	2,220	1,870	900	1,500	7,740	7,600	6,100	5,200	1,350	2,430	2,260
17	1,320	2,220	1,760	1,000	1,400	6,770	7,320	5,580	4,720	1,420	2,800	1,760
18	1,460	2,050	1,640	1,200	1,400	5,840	6,900	4,960	4,380	1,350	3,190	1,690
19	1,460	2,050	1,520	1,500	1,400	5,580	6,640	5,200	5,200	1,420	2,610	1,480
20	1,660	2,050	1,520	2,000	1,400	5,320	8,160	6,100	5,580	1,230	2,800	1,350
21	1,590	2,140	1,520	3,000	1,400	6,100	9,770	6,770	4,610	1,000	2,990	1,290
22	1,660	2,220	1,470	6,000	1,500	6,900	10,400	6,230	4,500	1,170	2,080	850
23	1,660	2,220	1,410	12,000	1,500	7,600	11,600	5,450	4,380	1,110	2,000	850
24	1,740	1,890	1,360	10,000	1,500	8,300	16,300	5,200	3,600	1,230	2,000	755
25	1,810	2,780	1,240	8,000	1,600	8,160	13,300	6,230	3,290	1,550	2,080	1,110
26	2,140	3,380	1,190	8,000	1,800	18,500	11,000	6,230	2,900	1,620	1,690	1,420
27	2,220	3,700	1,190	7,000	2,000	20,200	11,200	15,700	2,700	1,480	1,290	950
28	2,870	3,920	1,210	7,000	4,000	18,200	16,300	17,600	2,700	1,480	1,230	1,230
29	2,310	3,700	1,310	6,000	....	17,500	13,900	15,000	2,700	1,480	1,170	3,710
30	1,810	3,380	1,260	5,000	....	18,400	10,500	10,800	2,520	1,350	1,110	3,500
31	1,810	....	1,020	4,000	....	21,500	....	10,700	....	1,920	1,110	....

cticut River at Orford, N. H.. for the years ending
00–1915—Continued.

.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
0	1,400	9,320	30,800	2,710	1,450	2,020	3,900
0	1,300	8,020	32,600	2,800	1,320	2,100	2,710
0	1,300	7,600	34,500	3,000	1,140	1,580	2,020
0	1,300	6,650	32,100	3,690	1,080	1,520	2,020
0	1,300	6,520	31,500	3,180	1,260	1,320	1,860
0	1,300	6,780	21,500	2,710	1,200	1,320	2,020
0	1,300	10,400	15,700	2,620	1,030	1,260	2,020
0	1,300	21,900	11,600	4,340	975	1,140	2,530
0	1,200	19,700	12,500	2,800	975	1,030	2,800
0	1,200	19,700	12,100	1,790	1,030	1,030	3,090
0	1,200	18,000	10,500	1,720	1,080	770	2,800
0	1,200	17,600	10,200	1,790	1,030	770	2,260
0	1,200	18,200	9,770	1,940	820	870	2,260
0	1,200	21,500	8,740	2,100	870	870	2,260
0	1,200	23,600	7,740	2,350	680	920	1,940
0	1,300	25,900	6,920	2,440	820	870	2,020
0	1,300	24,600	6,390	3,280	920	920	2,440
0	1,300	20,700	5,880	3,480	1,520	1,030	2,350
0	1,300	18,000	5,260	3,090	1,520	1,320	2,020
0	1,300	16,600	4,900	2,800	1,320	1,580	2,020
0	1,300	15,900	4,000	2,530	1,030	1,860	2,020
0	1,400	15,300	3,900	2,260	1,030	2,100	1,860
0	1,400	14,200	3,800	2,180	1,030	2,260	1,720
0	1,500	12,600	3,580	2,020	1,030	2,100	1,650
0	1,500	12,500	3,380	1,860	820	1,860	1,940
0	1,500	16,100	3,480	1,650	1,030	1,650	2,020
0	3,500	19,700	3,800	1,580	1,520	1,060	2,020
0	[illegible],000	22,900	3,690	1,450	1,140	1,200	3,690
..	10,400	25,900	3,580	1,520	1,320	2,350	3,380
..	10,700	28,900	3,090	1,450	2,020	4,780	3,180
..	10,200	....	2,900	....	2,530	4,670	......

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
00	1,400	13,300	13,300	28,400	2,080	950	2,990
00	1,400	14,200	10,800	30,600	1,840	1,170	2,890
00	1,400	11,800	9,770	28,400	1,690	1,420	2,700
00	1,400	10,500	9,180	25,400	1,620	1,840	2,340
00	1,400	9,800	8,300	20,500	1,550	2,420	2,160
00	1,400	10,700	9,320	17,600	1,920	2,340	2,160
00	1,400	18,000	9,180	13,700	1,840	2,000	2,000
00	1,400	36,700	9,620	11,300	1,760	1,760	2,000
00	1,400	34,500	9,180	10,700	1,620	1,620	1,840
00	1,400	25,000	9,030	9,030	1,420	1,620	1,920
00	1,400	21,100	9,470	8,020	1,170	1,620	1,840
00	1,400	18,900	9,470	7,460	1,290	1,920	1,840
00	1,400	16,600	9,620	7,180	1,290	2,340	3,290
00	1,400	15,900	10,700	6,900	1,420	2,000	3,710
00	1,600	16,100	11,600	6,630	1,290	2,000	3,820
00	2,200	21,700	10,800	6,100	1,170	2,990	3,500
00	3,800	31,700	12,300	5,580	1,170	3,820	5,080
00	4,600	35,000	12,600	5,330	1,170	2,520	4,380
00	6,200	36,300	11,600	3,930	1,110	2,160	4,160
00	8,000	34,100	10,100	4,610	1,060	1,840	5,080
70	10,000	28,400	11,600	4,050	1,060	1,480	10,200
00	7,800	22,500	15,200	3,820	1,360	1,420	11,600
00	7,000	20,900	13,300	3,500	1,550	1,290	10,500
00	5,700	25,400	10,700	3,090	1,550	1,290	7,460
00	5,200	26,300	10,400	2,890	1,420	1,290	5,580
00	4,600	24,600	10,100	2,700	1,290	1,550	4,610
00	4,000	20,300	9,470	2,520	1,230	3,600	3,710
00	3,800	18,500	8,020	2,420	1,170	5,330	3,290
00	5,300	18,200	6,900	2,700	1,170	4,500	2,990
....	7,600	16,400	12,800	2,160	1,060	3,500	3,500
....	12,100	....	20,900	....	850	3,090	......

Daily discharge, in second-feet, of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	5,080	3,930	3,290	6,220	7,880	4,000	25,200	8,880	12,800	2,110	2,650	1,360
2	5,330	4,160	3,290	6,100	7,740	3,800	23,200	7,740	9,920	1,790	2,290	1,220
3	4,840	4,160	4,380	5,960	6,630	3,600	18,500	7,320	8,020	1,790	2,110	980
4	4,050	3,930	6,360	9,030	6,220	3,500	15,500	6,900	7,040	1,360	1,950	880
5	3,710	3,930	8,020	9,180	5,580	3,500	18,900	6,360	6,360	1,220	1,950	980
6	3,500	3,710	7,180	7,740	4,960	3,000	20,900	6,220	5,580	1,570	1,870	830
7	3,090	3,500	7,460	8,020	4,380	2,500	18,900	6,220	5,080	1,500	1,790	780
8	2,790	9,030	7,460	8,020	4,160	2,200	14,600	5,580	4,840	1,500	2,290	780
9	2,600	11,300	6,360	7,740	4,050	1,800	11,800	5,080	5,080	1,500	1,950	880
10	2,700	12,600	5,460	6,630	3,710	1,420	10,100	4,610	5,080	1,500	1,950	685
11	2,700	10,100	5,460	5,330	3,710	5,000	9,470	4,160	4,610	1,500	1,360	618
12	2,700	7,740	5,580	5,960	3,400	5,000	9,770	4,050	4,050	1,600	1,430	730
13	2,790	6,360	6,360	6,630	3,500	9,000	9,470	4,050	3,930	1,600	1,360	640
14	2,700	6,100	6,100	6,360	3,500	12,000	11,000	4,050	3,490	1,800	1,360	640
15	3,090	6,700	6,220	6,630	3,400	15,000	11,300	3,930	3,160	2,000	1,430	550
16	3,500	6,700	6,700	6,360	3,500	27,600	12,000	3,930	3,160	2,000	1,160	640
17	3,500	6,700	6,360	6,360	3,400	27,600	12,300	3,930	3,270	2,110	1,430	730
18	2,890	5,460	5,460	8,600	3,290	22,500	12,600	3,930	3,490	2,110	1,220	685
19	2,700	5,080	5,330	13,300	3,290	18,200	11,800	4,040	3,710	2,290	1,160	730
20	2,520	4,610	6,630	14,400	3,190	18,200	12,300	4,380	3,380	2,290	980	685
21	2,520	4,380	6,360	15,500	3,290	23,400	12,000	4,610	3,050	2,290	780	780
22	2,700	4,160	5,580	15,200	3,710	30,600	11,300	4,380	2,850	2,470	830	880
23	2,890	4,380	4,380	14,000	4,500	29,900	10,800	5,330	2,470	2,290	780	1,790
24	6,360	4,610	4,160	13,700	5,500	25,400	10,500	10,100	2,290	1,950	595	2,470
25	8,880	4,840	4,050	12,600	5,000	26,500	10,100	12,600	2,030	1,710	780	2,650
26	7,740	4,720	3,930	9,620	4,500	38,900	11,000	11,000	1,870	1,640	1,040	2,850
27	6,630	4,610	3,930	9,030	4,000	47,600	12,000	8,600	1,950	1,950	980	2,110
28	5,960	4,380	3,930	8,020	3,500	56,000	11,600	7,180	2,110	2,380	780	1,640
29	5,330	3,710	3,820	6,900	....	49,600	10,700	10,400	3,050	4,960	980	1,570
30	4,610	3,500	3,930	5,840	....	39,400	10,200	15,700	2,470	4,380	780	1,100
31	4,050	....	5,330	6,100	....	29,700	....	14,000	....	3,600	1,100	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	1,500	6,100	2,850	1,360	1,950	1,100	11,200	24,200	3,270	1,500	1,360	2,650
2	930	5,200	3,050	1,290	2,030	2,290	16,800	19,100	3,050	1,790	1,640	2,470
3	1,100	4,050	3,160	1,220	1,640	5,960	20,100	16,800	3,270	2,470	1,160	2,110
4	1,500	3,930	3,270	1,360	1,790	7,740	16,800	15,900	3,270	3,050	1,220	1,870
5	1,710	3,380	3,490	1,790	1,870	7,040	12,600	17,800	4,500	2,950	1,430	1,640
6	2,110	3,270	3,270	1,640	1,790	5,700	9,030	20,300	4,840	2,850	1,790	1,790
7	2,110	3,050	3,270	1,500	1,640	4,840	6,630	20,700	4,040	2,850	2,030	1,790
8	1,950	3,050	3,270	1,360	1,500	4,260	6,500	19,300	3,490	2,290	1,950	1,640
9	1,640	3,160	4,160	1,500	1,500	3,710	13,500	17,800	3,270	1,950	1,290	1,790
10	1,220	5,330	5,330	1,640	1,500	3,270	16,800	18,200	2,950	2,380	1,220	1,570
11	1,360	7,040	6,900	1,500	1,220	2,856	14,600	17,800	2,470	2,650	1,360	1,360
12	1,640	6,360	6,760	1,430	1,040	2,650	15,000	16,600	2,110	2,470	1,290	1,790
13	2,030	5,080	6,630	1,160	980	2,380	15,200	14,400	1,950	2,200	1,500	1,790
14	2,290	4,610	6,360	1,100	980	2,290	12,500	11,600	1,790	2,290	1,500	1,640
15	2,290	3,820	5,840	1,160	880	2,200	10,800	10,100	1,640	2,560	1,430	1,500
16	2,290	3,270	5,330	1,160	930	2,290	10,800	8,740	1,500	2,110	1,290	1,430
17	2,110	3,050	4,960	1,220	980	2,560	10,500	7,880	1,570	1,790	980	1,290
18	2,110	3,050	4,500	1,290	930	3,600	11,000	7,180	1,570	1,570	1,040	1,040
19	2,110	2,850	4,050	1,290	980	4,260	14,600	6,900	1,570	1,710	1,100	980
20	2,110	2,950	3,490	1,290	980	4,150	27,400	6,760	1,570	1,640	1,100	1,220
21	4,050	4,500	3,160	1,290	980	3,600	42,000	6,360	1,790	1,500	1,220	1,160
22	5,200	6,360	2,950	1,220	930	3,380	44,300	5,840	1,950	1,570	1,220	980
23	4,840	5,840	2,650	1,220	1,040	3,050	40,100	5,580	1,790	1,500	1,360	980
24	3,930	4,720	2,470	1,220	980	2,750	32,300	5,080	1,790	1,500	1,500	1,100
25	3,270	4,160	2,290	1,220	1,040	2,560	22,300	4,720	1,790	1,360	1,500	980
26	4,160	4,040	2,030	1,360	980	2,650	16,600	4,840	1,640	1,220	1,640	1,160
27	6,630	3,710	1,870	1,360	930	4,500	17,600	4,840	1,500	1,100	1,360	1,360
28	8,600	3,270	1,950	1,640	980	9,770	18,400	4,610	1,640	1,160	930	1,710
29	7,740	3,050	1,640	1,640	....	11,300	19,200	4,380	1,710	1,100	980	1,790
30	6,360	2,850	1,570	1,790	....	11,800	24,200	3,930	1,500	1,360	1,640	1,790
31	6,100	....	1,500	1,950	....	11,600	....	3,490	....	1,570	2,560	....

ticut River at Orford, N. H., for the years ending
0–1915—Continued.

eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,040	18,200	2,030	12,000	2,850	2,470	6,360	2,470
730	13,000	2,200	11,800	2,290	3,490	5,460	2,290
730	10,700	2,290	10,200	2,030	3,930	6,100	2,110
730	8,880	2,290	8,740	2,030	4,050	5,330	1,950
730	8,020	2,380	7,460	1,950	4,040	4,840	1,790
730	7,320	2,560	6,760	1,950	4,160	3,930	1,790
880	6,900	2,750	5,840	1,640	4,380	3,490	1,640
,430	6,760	2,950	5,700	1,360	4,380	3,050	1,430
,430	6,360	4,040	6,630	1,500	11,800	3,600	1,430
,290	5,960	5,840	6,630	1,430	21,900	5,080	1,500
,100	5,200	10,800	6,220	1,430	20,100	8,600	1,870
880	4,610	19,300	5,330	1,790	14,000	9,770	2,380
780	4,610	23,800	4,960	2,470	8,740	8,160	2,560
730	4,720	21,700	4,380	2,470	5,840	6,100	2,380
980	4,610	18,400	3,930	2,110	4,610	5,080	2,110
,500	4,380	13,300	3,710	2,030	3,930	4,160	1,790
,560	4,040	10,800	3,380	1,950	3,710	4,380	1,570
,950	3,270	10,400	3,270	3,050	4,050	4,380	1,360
,950	2,950	9,620	3,160	4,380	8,020	4,050	1,360
,950	2,950	9,320	3,050	5,200	8,600	3,820	1,570
,750	3,270	9,030	2,950	4,380	6,900	3,160	1,790
,560	3,490	8,160	2,950	3,710	6,360	2,850	2,750
,380	3,270	7,180	3,050	3,050	7,180	3,930	5,080
,380	3,600	6,100	2,850	2,650	6,900	5,960	5,840
,300	3,930	6,630	2,470	2,470	5,580	6,100	4,840
,700	4,840	10,800	2,650	2,110	4,610	6,100	3,820
,000	5,080	14,400	3,050	1,950	4,720	5,580	3,270
,200	4,050	15,000	3,820	1,950	6,630	4,610	3,600
......	3,050	12,600	4,380	1,950	6,630	3,600	4,050
......	2,290	10,700	3,710	1,790	7,180	3,050	3,930
......	2,110	....	3,270	....	8,020	2,650	....

ined rating curve, the low-water part of which has been r slightly shifting control.

, to Mar. 24, 1901; Dec. 4–11, 1901; Dec. 24, 1901, to Feb. 26, , to Mar. 28, 1904; Nov. 17, 1904, to Mar. 25, 1905; Nov. 30 1906; Dec. 12, 1906, to Mar. 30, 1907; Dec. 1–10, 1907; Jan. 4 ec. 15, 1909, to Mar. 1, 1910; Dec. 6, 1910, to Mar. 28, 1911; 13; Dec. 21, 1913, to Apr. 4, 1914; and Dec. 14, 1914, to Feb. mated from gage heights, discharge measurements, and –16, 1913.

at Orford, N. H., for the years ending Sept. 30,
900–1915.

a, 3,100 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
um.	Minimum.	Mean.	Per square mile.		
,110	950	2,270	0.732	0.71	B.
,520	815	1,300	.419	.47	B.
,600	1,880	4,400	1.42	1.64	A.
,300	1,600	7,560	2.44	2.72	A.
,900	4,010	5,170	1.67	1.92	B.
,500	2,400	2,930	.945	1.09	D.
,500	1,900	2,220	.716	.75	D.
,300	1,800	5,400	1.74	2.01	D.
,600	11,000	23,200	7.48	8.34	B.
,300	5,550	9,030	2.91	3.36	A.
,600	2,610	5,240	1.69	1.89	A.
,450	1,280	3,300	1.07	1.23	A.
,640	1,100	3,690	1.19	1.37	A.
,110	1,100	1,580	.510	.57	B.
,600	1,100	6,150	1.98	26.89	

Monthly discharge of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1901–2.						
October	5,220	1,340	2,250	0.726	0.84	A.
November	2,350	1,280	1,710	.552	.62	B.
December	30,400	1,460	6,600	2.13	2.46	D.
January	6,000	2,700	3,810	1.23	1.28	D.
February	8,000	2,000	2,810	.906	1.04	D.
March	43,400	9,770	20,500	6.61	7.62	B.
April	23,200	8,600	13,000	4.19	4.68	A.
May	31,900	4,560	10,600	3.42	3.94	A.
June	17,000	4,890	9,590	3.09	3.45	A.
July	6,770	2,520	4,250	1.37	1.58	A.
August	8,300	2,190	4,390	1.42	1.64	A.
September	5,330	2,030	3,430	1.11	1.24	A.
The year	43,400	1,280	6,950	2.24	30.39	
1902–3.						
October	19,700	2,350	4,420	1.43	1.65	A.
November	10,100	3,470	4,990	1.61	1.80	B.
December	3,560	2,580	2,930	.945	1.09	C.
January	3,560	2,260	2,840	.916	1.06	C.
February	4,170	2,720	3,320	1.07	1.11	C.
March	40,100	11,500	24,300	7.84	9.04	B.
April	22,900	5,110	11,100	3.58	3.99	A.
May	5,780	1,460	3,340	1.08	1.24	A.
June	7,740	1,100	3,090	.997	1.11	A.
July	4,010	1,400	2,310	.745	.86	A.
August	3,470	1,280	2,120	.684	.79	A.
September	2,030	640	1,100	.355	.40	B.
The year	40,100	640	5,510	1.78	24.14	
1903–4.						
October	2,030	860	1,300	.419	.48	B.
November	2,110	1,050	1,480	.477	.53	B.
December	2,800	1,040	1,540	.497	.57	C.
January	980	650	785	.253	.29	C.
February	1,220	700	830	.268	.29	C.
March	21,700	1,160	5,240	1.69	1.95	B.
April	22,100	6,640	12,800	4.13	4.61	A.
May	23,600	6,260	14,400	4.65	5.36	A.
June	6,260	1,400	3,010	.971	1.08	A.
July	2,350	815	1,420	.458	.53	B.
August	4,780	905	1,980	.639	.74	B.
September	7,460	1,280	3,690	1.19	1.33	A.
The year	23,600	650	4,050	1.31	17.76	
1904–5.						
October	10,800	3,270	5,550	1.79	2.06	A.
November	3,790	1,750	2,570	.829	.92	C.
December	2,110	900	1,210	.390	.45	C.
January	1,070	700	868	.280	.32	C.
February	760	600	681	.220	.23	C.
March	37,200	560	7,110	2.29	2.64	C.
April	33,200	7,040	13,400	4.32	4.82	A.
May	13,000	4,120	8,400	2.71	3.12	A.
June	7,460	2,610	4,180	1.35	1.51	A.
July	17,600	1,530	4,390	1.42	1.64	A.
August	7,320	1,460	3,430	1.11	1.28	A.
September	10,400	2,520	5,410	1.75	1.95	A.
The year	37,200	560	4,780	1.54	20.94	
1905–6.						
October	3,270	1,880	2,620	.845	.97	A.
November	5,200	2,030	3,050	.984	1.10	B.
December	10,200	3,070	5,660	1.83	2.11	C.
January	27,100	2,000	7,060	2.28	2.63	C.
February	8,020	2,050	3,030	.977	1.02	C.
March	6,600	1,500	2,240	.723	.83	C.
April	30,200	3,000	11,800	3.81	4.25	C.
May	27,600	7,320	14,200	4.58	5.28	A.
June	14,600	3,270	6,580	2.12	2.36	A.
July	4,010	1,670	2,630	.848	.98	A.
August	4,010	1,050	1,790	.577	.67	B.
September	3,570	950	1,600	.516	.58	B.
The year	30,200	950	5,200	1.68	22.78	

ut Orford, N. H., for the years ending Sept. 30,
15—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
mum.	Minimum.	Mean.	Per square mile.		
,000	1,000	2,760	0.890	1.03	A.
,670	1,530	2,670	.861	.96	A.
,070	1,500	1,960	.632	.73	B.
,550	1,400	1,960	.632	.73	C.
,440	980	1,190	.384	.40	C.
,000	1,240	3,970	1.28	1.48	C.
,600	7,320	14,400	4.65	5.19	B.
,600	5,320	15,900	5.13	5.91	B.
,100	2,520	4,690	1.51	1.68	A.
,770	2,270	4,600	1.48	1.71	A.
230	1,050	2,600	.839	.97	A.
180	1,340	3,010	.971	1.08	A.
600	980	4,990	1.61	21.87	
700	3,590	8,940	2.88	3.32	A.
900	3,480	7,810	2.52	2.81	A.
500	2,000	9,320	3.01	3.47	C.
320	2,350	4,410	1.42	1.64	C.
000	2,320	4,830	1.56	1.68	C.
600	2,200	7,580	2.45	2.82	C.
700	6,900	12,800	4.13	4.61	B.
400	5,200	12,700	4.10	4.73	B.
500	1,520	4,450	1.44	1.61	A.
310	980	1,530	.494	.57	B.
810	880	1,690	.545	.63	B.
980	288	627	.202	.23	B.
700	288	6,400	2.06	28.12	
040	550	747	.241	.28	B.
780	640	1,040	.335	.37	B.
050	698	1,200	.387	.45	B.
000	1,020	2,690	.868	1.00	C.
320	2,100	4,000	1.29	1.34	C.
300	2,320	3,620	1.17	1.35	C.
700	7,000	25,400	8.19	9.14	C.
200	6,770	14,400	4.65	5.36	B.
320	1,590	3,890	1.25	1.40	A.
400	930	1,490	.481	.55	B.
090	640	836	.270	.31	B.
450	880	1,460	.471	.53	B.
700	550	5,050	1.63	22.08	
360	1,320	2,360	.761	.88	A.
920	1,660	2,380	.768	.86	A.
030	1,020	2,070	.668	.77	B.
000	900	3,130	1.01	1.16	C.
000	1,400	2,000	.645	.67	C.
500	5,320	12,800	4.13	4.76	B.
500	6,640	14,500	4.68	5.22	B.
600	4,960	9,080	2.93	3.38	A.
800	2,520	6,050	1.95	2.18	A.
520	1,000	1,630	.526	.61	A.
230	1,110	2,430	.784	.90	A.
710	755	1,740	.561	.63	A.
500	755	5,020	1.62	22.02	
290	1,060	2,040	.658	.76	A.
150	1,550	2,510	.810	.90	A.
000	1,000	1,520	.490	.56	C.
500	1,600	2,520	.813	.94	C.
600	1,000	1,360	.439	.46	C.
700	1,200	2,450	.790	.91	C.
900	6,520	16,800	5.42	6.05	B.
500	2,900	11,300	3.65	4.21	A.
340	1,450	2,440	.787	.88	A.
530	680	1,180	.381	.44	B.
780	770	1,620	.523	.60	B.
900	1,650	2,360	.761	.85	A.
500	680	4,010	1.29	17.56	

Monthly discharge of Connecticut River at Orford, N. H., for the years ending Sept. 30, 1900–1915—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1911–12.						
October	6,520	2,350	4,310	1.39	1.60	A.
November	7,050	3,180	4,340	1.40	1.56	A.
December	17,800	4,560	8,250	2.66	3.07	A.
January	7,460	1,600	3,110	1.00	1.15	C.
February	1,600	1,200	1,420	.458	.49	C.
March	12,100	1,400	3,840	1.24	1.43	C.
April	36,700	9,800	21,800	7.03	7.84	C.
May	20,900	6,900	10,800	3.48	4.01	A.
June	30,600	2,160	9,570	3.09	3.45	A.
July	2,080	850	1,390	.448	.52	B.
August	5,330	950	2,220	.716	.83	A.
September	11,600	1,840	4,100	1.32	1.47	A.
The year	36,700	850	6,250	2.02	27.42	
1912–13.						
October	8,880	2,520	4,010	1.29	1.49	A.
November	12,600	3,500	5,640	1.82	2.03	A.
December	8,020	3,290	5,450	1.76	2.03	B.
January	15,500	5,330	8,740	2.82	3.25	B.
February	7,880	3,190	4,410	1.42	1.48	C.
March	56,000	1,420	18,900	6.10	7.03	C.
April	25,200	9,470	13,300	4.29	4.79	B.
May	15,700	3,930	6,750	2.18	2.51	A.
June	12,800	1,870	4,340	1.40	1.56	A.
July	4,960	1,220	2,090	.674	.78	A.
August	2,650	595	1,390	.448	.52	B.
September	2,850	550	1,130	.365	.41	B.
The year	56,000	550	6,370	2.05	27.88	
1913–14.						
October	8,600	930	3,130	1.01	1.16	A.
November	7,040	2,850	4,170	1.35	1.51	A.
December	6,900	1,500	3,680	1.19	1.37	A.
January	1,950	1,100	1,390	.448	.52	B.
February	2,030	880	1,250	.403	.42	B.
March	11,800	1,100	4,580	1.48	1.71	C.
April	44,300	6,500	18,300	5.90	6.58	C.
May	24,200	3,490	11,300	3.65	4.21	A.
June	4,840	1,500	2,360	.761	.85	A.
July	3,050	1,100	1,940	.626	.72	A.
August	2,560	930	1,410	.455	.52	B.
September	2,650	980	1,550	.500	.56	B.
The year	44,300	880	4,600	1.48	20.13	
1914–15.						
October	3,600	1,040	1,910	.616	.71	C.
November	4,960	1,500	3,230	1.04	1.16	B.
December	6,630	880	2,500	.806	.93	B.
January	5,580	730	2,160	.697	.80	B.
February	33,700	730	4,910	1.58	1.64	B.
March	18,200	2,110	5,560	1.79	2.06	A.
April	23,800	2,030	9,250	2.98	3.32	A.
May	12,000	2,470	5,110	1.65	1.90	A.
June	5,200	1,360	2,400	.774	.86	A.
July	21,900	2,470	7,000	2.26	2.61	A.
August	9,770	2,650	4,950	1.60	1.84	A.
September	5,840	1,360	2,540	.819	.91	A.
The year	33,700	730	4,290	1.38	18.74	

necticut River at Orford, N. H., during the years
ept. 30, 1901–1915.

Days of deficiency in discharge.									
1905–6	1906–7	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15
.....	.....	4	.....	.....	.....	.....	.....	.....	.....
2	1	34	94	12	15	2	30	22	20
35	80	61	158	75	110	58	47	83	57
71	135	86	192	132	179	99	74	166	102
131	164	126	209	188	236	133	96	197	137
178	197	144	228	207	270	146	114	217	171
213	215	159	253	218	287	159	134	248	210
233	236	175	268	233	304	186	168	256	236
260	258	191	277	239	308	206	194	268	259
267	276	199	283	243	312	216	209	282	277
278	291	221	295	256	314	245	238	295	298
289	298	243	304	276	319	267	271	310	319
295	304	258	307	289	322	278	284	316	324
305	319	271	311	303	324	285	293	318	334
313	324	285	313	314	326	302	308	320	338
341	340	334	328	334	338	332	339	336	354
350	350	352	343	353	350	344	348	354	358
359	354	359	353	365	357	352	352	360	363
364	356	361	356	.....	360	359	359	361	363
365	361	365	357	.....	365	363	360	362	365
.....	364	366	360	.....	.....	366	362	362	.....
.....	365	.....	362	.....	.....	.....	362	365	.....
.....	.....	.....	365	.....	.....	.....	364	.....	.....
.....	.....	.....	.....	.....	.....	.....	365	.....	.....

horsepower per foot of fall that may be developed at different
ys on which the discharge and corresponding horsepower
n the columns for discharge and horsepower. In using this
losses, the principal ones being the wheel loss, which may
ich may be as large as 5 per cent.

R AT SUNDERLAND, MASS.

hway bridge at Sunderland, about 18 miles in
r above the dam at Holyoke. Deerfield River
vest about 8 miles above the station.
o September 30, 1915.
s.
bridge.
om the bridge.
deep, bottom of coarse gravel and alluvium.
ned but practically permanent; at high stages
n at Holyoke.
n stage during 1904–1915, 30.7 feet during the
5) (determined by leveling from flood-marks)
from extension of rating curve, 101,000 second-
0.6 foot September 28 and November 8, 1914
from extension of rating curve, 700 second-feet.)
riously affected by ice for several months.
ation of various power plants on the main river
The effect of the regulation is shown by low
Mondays.
y; record good.

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published in previous reports.

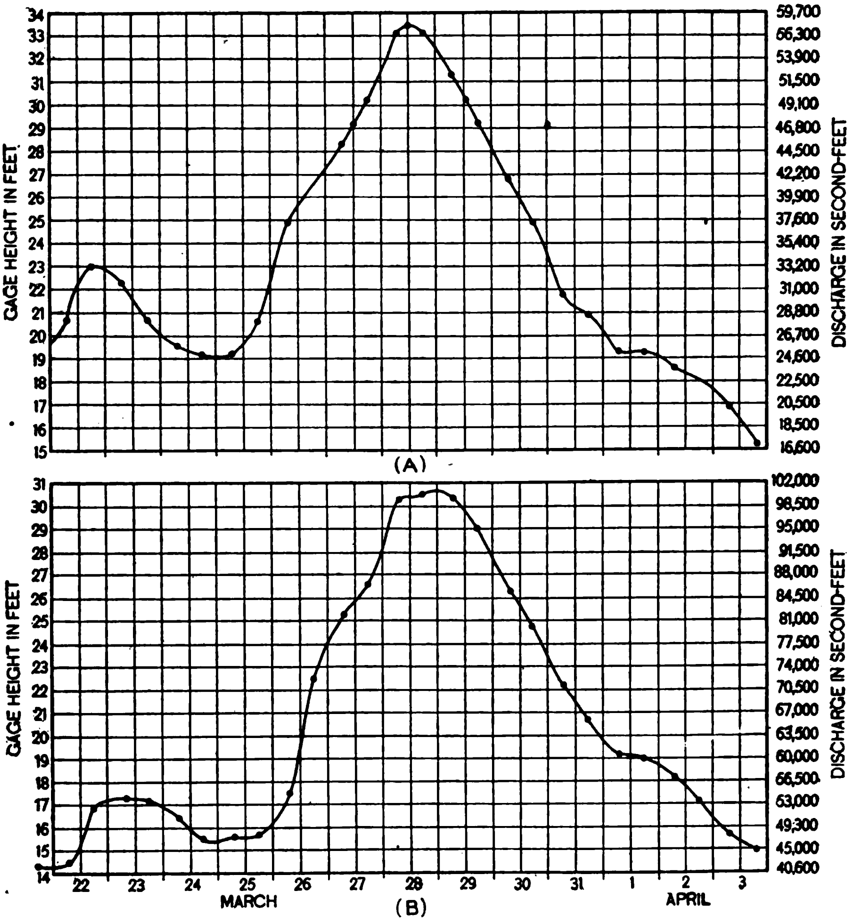

Figure 5.—Hydrographs of Connecticut River: (A) Orford, N. H.; (B) Sunderland, Mass.; March 22 to April 3, 1913.

iver at Sunderland, Mass., during 1904–1915.

ge.	Date.	Made by—	Gage height.	Discharge.
ft.	1909.		*Feet.*	*Sec.-ft.*
00	Mar. 3	D. M. Wood	[b] 11.00	15,300
00	June 3	.....do	6.88	13,300
00	July 16	.....do	2.53	2,940
00	Oct. 13	.....do	3.02	3,660
00	Dec. 21	F. F. Henshaw	[b] 4.45	4,430
60				
90	1910.			
00	Feb. 15	D. M. Wood	[b] 5.86	5,580
10	Mar. 9	.....do	14.55	41,700
	Sept. 15	W. G. Hoyt	3.26	4,230
00	1911.			
00	Apr. 13	W. G. Hoyt	12.06	33,000
00	29	C. S. De Golyer	15.80	48,700
00				
00	1912.			
00	Feb. 12	G. H. Canfield	[b] 4.39	3,130
40	13	.....do	[b] 5.19	4,310
00				
	1913.			
	Aug. 10	C. H. Pierce	2.54	2,940
00				
20	1914.			
30	Jan. 17	R. S. Barnes	[b] 4.20	4,700
	Mar. 5	Pierce and Barnes	[b] 13.42	26,400
	Apr. 30	.....do	18.69	58,400
00	Aug. 20	C. H. Pierce	2.22	2,530
00	Nov. 2	R. S. Barnes	1.10	1,180
20	Dec. 22	.....do	[b] 3.60	2,760
	1915.			
40	Jan. 9	R. S. Barnes	[b] 5.83	5,780
00	Feb. 7	.....do	[b] 6.45	7,800
60	24	.....do	[b] 7.15	9,040
60	27	.....do	21.27	68,600
	28	.....do	17.50	55,100
	Sept. 25	Hardin Thweatt	4.48	7,050
30				
00				

[b] Discharge relation affected by ice.

cticut River at Sunderland, Mass., for the years pt. 30, 1904–1915.

t.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
	1904.						
90	16	31,200	23,400	7,220	3,720	2,310	20,800
80	17	27,200	26,100	6,760	3,720	3,460	15,500
30	18	25,500	29,200	6,300	4,180	3,540	14,000
10	19	26,500	33,700	5,150	4,000	3,720	12,800
40	20	26,100	43,400	4,490	4,080	4,380	10,600
00	21	24,000	45,100	4,710	3,900	9,280	8,660
00	22	22,900	40,900	4,930	3,460	8,910	8,060
70	23	23,100	34,800	4,490	3,290	9,160	9,160
80	24	24,000	28,400	4,380	2,500	8,910	10,200
10	25	27,200	23,400	4,280	3,290	9,160	9,410
50	26	33,700	21,200	4,180	3,460	8,180	9,040
00	27	38,100	20,400	4,280	3,210	7,700	11,900
80	28	48,700	18,600	4,080	3,370	6,760	12,800
80	29	68,500	16,100	4,380	3,540	5,500	12,800
700	30	69,000	14,700	4,710	3,720	4,930	14,400
	31	......	14,200	......	4,280	4,710	......

Daily discharge, in second-feet, of Connecticut River at Sunderland, Mass., for the years ending Sept. 30, 1904–1915—Continued.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1904–5.										
1	19,300	10,600	7,940	....	87,900	21,600	8,660	11,600	26,100	7,140
2	18,600	9,670	7,940	....	75,000	21,700	7,630	9,470	20,800	10,200
3	19,300	9,280	9,280	....	60,900	20,800	6,780	7,380	16,800	15,900
4	18,900	8,910	10,200	....	51,300	19,900	6,320	13,300	15,200	33,000
5	16,800	8,660	8,660	....	44,300	19,000	6,210	21,600	12,200	40,900
6	14,500	8,300	8,180	....	44,300	19,600	6,900	21,200	9,060	34,100
7	12,300	7,700	8,420	....	48,000	20,500	7,140	16,600	7,760	27,100
8	10,800	8,060	8,180	....	42,800	20,600	8,930	12,200	7,630	21,700
9	9,670	7,460	8,180	....	36,500	20,100	9,750	9,340	6,780	17,600
10	9,160	7,220	7,700	....	33,200	19,000	8,930	7,630	6,210	14,100
11	9,540	6,760	....	....	37,600	18,300	7,760	7,140	6,670	11,800
12	10,200	6,530	....	....	47,400	17,100	6,670	6,210	8,530	12,400
13	10,800	6,070	....	....	46,100	16,200	6,670	5,770	8,530	16,900
14	10,500	6,180	....	....	40,900	15,400	7,380	5,550	7,880	16,200
15	10,500	6,760	....	....	37,200	14,300	8,270	5,130	7,260	13,200
16	10,200	6,760	....	....	33,500	14,600	8,930	4,820	7,630	10,900
17	9,160	6,760	....	....	30,200	16,200	8,800	4,520	12,200	9,610
18	9,160	5,960	....	....	26,700	16,200	7,630	4,920	15,400	9,750
19	8,540	5,720	....	....	23,400	15,700	6,670	4,920	13,600	38,000
20	8,180	6,070	....	....	20,600	14,400	6,900	5,340	11,000	38,200
21	8,420	6,180	....	....	19,400	13,300	7,760	5,770	9,060	33,400
22	26,500	6,990	....	....	21,900	12,400	14,600	5,770	7,760	32,200
23	23,400	8,300	....	....	26,100	12,200	16,100	5,550	6,560	26,100
24	19,500	8,180	....	....	27,700	11,500	12,800	4,720	5,660	21,200
25	16,400	7,940	....	....	26,700	10,600	9,750	4,720	5,340	16,900
26	14,000	7,460	....	....	24,100	8,930	8,530	4,320	4,820	14,400
27	12,500	7,460	....	59,100	21,700	8,270	9,610	4,130	4,620	12,500
28	13,100	7,340	....	70,400	20,500	7,630	9,610	4,130	4,320	11,500
29	12,800	7,700	....	70,200	19,900	8,660	11,200	3,950	4,130	10,600
30	11,700	8,180	....	79,800	20,500	10,500	12,700	3,950	4,820	9,890
31	11,000	....	....	86,800	....	9,750	....	10,600	6,780	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1905–6.												
1	8,930	5,990	15,100	17,600	14,900	19,300	25,500	21,500	35,500	10,300	8,430	5,520
2	8,140	5,990	11,600	16,600	13,900	15,600	21,600	21,500	27,200	16,600	8,300	4,370
3	8,400	5,990	13,000	13,800	16,900	14,100	18,400	25,700	21,600	15,800	7,400	3,880
4	7,880	6,440	36,300	12,800	13,300	23,800	18,400	29,500	20,200	14,300	7,650	3,350
5	7,630	7,140	30,000	14,300	14,400	29,200	23,100	29,000	19,100	13,300	7,650	3,190
6	7,140	7,630	23,700	15,200	14,900	23,300	29,000	26,100	17,400	12,400	6,550	3,700
7	6,670	9,340	19,600	14,400	....	19,100	29,500	25,100	17,000	10,600	5,970	4,070
8	6,210	12,100	16,600	13,800	....	16,500	26,400	24,800	18,800	8,960	6,080	3,880
9	5,660	11,500	14,700	13,200	....	15,800	23,800	23,100	23,500	7,910	5,410	3,700
10	5,990	10,300	13,200	12,700	....	13,700	22,400	27,900	24,600	7,030	4,570	3,700
11	5,880	9,470	12,400	12,100	....	9,780	21,600	31,600	23,800	7,150	3,980	3,350
12	6,210	8,930	10,500	12,200	....	8,690	24,600	29,100	21,600	7,150	3,880	3 030
13	8,400	8,140	10,600	14,100	....	7,400	29,400	27,200	18,800	7,280	3,700	3,190
14	9,060	8,400	9,610	15,200	....	7,280	33,100	27,600	15,600	7,030	3,520	2,880
15	8,660	8,270	11,200	14,400	....	7,650	46,800	31,600	13,300	6,200	3,520	2,810
16	7,760	8,140	13,800	14,300	....	10,500	72,300	29,500	10,900	5,520	3,440	2,280
17	7,760	7,880	13,200	15,600	....	11,500	71,200	28,300	10,100	4,780	3,440	2,740
18	7,140	7,630	12,700	15,600	....	8,430	64,600	25,900	11,800	5,970	3,030	2,340
19	6,900	7,500	12,200	15,200	....	6,320	59,600	23,300	15,300	7,400	2,340	2,540
20	7,380	7,140	12,700	13,900	....	9,230	56,600	21,300	15,000	6,430	2,600	2,470
21	9,060	6,670	12,700	13,300	....	10,300	53,100	20,600	12,700	5,300	2,280	2,470
22	9,610	5,990	14,600	13,900	....	7,400	49,400	19,500	10,600	5,090	2,740	2,670
23	8,660	5,770	15,600	26,900	....	5,860	47,200	17,400	8,960	6,200	3,980	2,340
24	8,800	5,770	15,200	44,600	....	5,300	44,900	15,100	10,300	6,430	3,030	3,030
25	8,270	5,990	13,500	52,200	....	5,300	40,100	13,500	15,000	6,550	3,030	2,470
26	7,630	5,770	12,200	40,000	....	4,780	34,200	14,100	15,300	5,970	2,600	2,600
27	7,380	5,770	12,100	33,700	....	5,520	27,900	16,600	13,700	5,200	3,190	2,670
28	6,780	6,320	11,500	29,100	23,100	15,600	25,700	43,800	11,500	4,570	3,110	2,540
29	6,210	6,900	11,600	24,800	....	25,300	21,800	64,900	10,200	4,570	3,190	2,400
30	5,770	15,100	15,200	19,200	....	27,200	20,900	59,900	8,690	5,520	5,740	1,850
31	5,770	....	17,100	15,900	....	26,400	....	47,200	....	6,910	6,320	....

nnecticut River at Sunderland, Mass., for the years
30, 1904–1915—Continued.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	56,200	50,800	12,600	12,800	6,670	2,230
....	50,600	53,700	11,500	13,400	7,370	2,230
....	40,600	54,900	14,400	14,200	8,610	2,290
....	33,900	54,800	19,700	15,400	9,540	2,480
....	30,900	54,400	17,600	15,900	9,400	4,300
....	32,500	49,700	20,400	14,500	9,130	6,780
....	30,900	41,100	20,200	12,300	8,610	7,130
....	27,800	35,300	17,600	10,200	8,100	9,000
....	25,400	32,300	15,200	8,350	7,370	7,980
....	23,700	28,700	13,600	7,610	6,900	7,020
....	22,100	27,600	12,900	7,370	6,110	6,440
....	21,000	27,400	11,700	7,730	5,480	6,330
....	21,000	26,800	10,800	11,100	4,970	6,670
....	21,500	24,700	9,670	10,500	4,210	6,440
....	23,900	21,500	8,220	9,000	4,030	7,020
....	26,200	20,200	7,490	8,610	4,120	7,250
....	25,300	28,300	7,020	8,610	3,850	6,900
....	23,900	36,600	6,670	8,350	3,510	6,000
....	22,800	33,500	6,440	8,100	3,680	5,170
....	21,700	29,700	6,220	6,670	2,750	4,870
20,100	19,500	26,200	6,440	6,220	3,040	4,480
21,200	18,300	22,600	9,000	6,780	3,270	4,120
27,200	18,000	19,700	13,600	6,000	3,350	4,300
51,200	22,200	17,200	12,600	5,790	3,190	8,610
40,400	42,800	15,400	10,800	8,220	2,350	9,800
28,300	49,700	13,700	8,740	9,130	2,960	9,400
21,900	56,200	13,400	7,850	7,490	2,230	8,480
26,000	62,400	16,200	7,980	6,900	2,230	7,980
43,900	56,200	16,700	8,100	6,220	2,890	9,130
57,900	51,900	15,000	9,670	5,680	2,750	26,600
61,000	....	13,600	....	6,000	2,350	....

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	49,500	58,800	24,700	3,940	2,890	2,890
....	42,400	61,000	20,400	3,600	2,960	2,750
....	36,000	54,600	19,700	3,600	2,960	2,480
....	29,700	50,300	19,200	3,600	2,680	2,420
....	24,300	45,400	16,600	3,760	2,820	2,290
....	21,900	38,500	13,200	3,680	3,270	2,230
....	24,300	32,700	11,200	4,210	4,870	2,230
....	27,800	41,500	9,400	3,940	5,580	2,000
....	36,200	47,600	9,000	3,510	8,220	2,000
....	38,900	46,800	7,850	3,430	8,350	2,230
....	35,100	43,500	7,130	3,120	7,610	2,110
....	36,400	40,000	6,780	2,960	6,560	2,060
....	35,300	35,300	6,440	2,960	5,900	1,950
....	32,100	32,300	6,220	2,610	6,110	1,950
....	28,300	36,800	5,580	2,610	5,580	1,800
....	28,500	36,200	6,000	3,350	5,070	1,760
....	28,700	30,700	8,350	2,680	4,680	1,900
....	27,800	26,200	15,200	2,420	4,680	1,850
....	28,100	23,000	16,200	2,170	5,900	1,950
....	31,500	20,400	14,000	2,680	4,970	1,850
....	29,500	19,000	11,100	2,680	4,680	1,900
....	25,300	19,200	8,870	2,960	4,680	1,850
....	22,200	24,500	7,730	5,370	4,680	1,800
....	23,400	21,200	6,670	5,370	4,680	1,760
....	24,900	17,200	6,000	5,070	4,300	1,670
41,900	28,100	15,200	5,680	8,480	4,030	1,670
40,100	34,900	14,400	5,170	6,440	3,760	1,410
54,800	41,500	13,900	4,870	4,480	3,600	1,850
59,300	50,100	12,300	4,120	4,870	3,350	1,950
63,300	54,400	12,800	4,210	3,430	3,120	1,710
57,000	....	20,400	....	2,960	2,960	....

Daily discharge, in second-feet, of Connecticut River at Sunderland, Mass., for the years ending Sept. 30, 1904–1915—Continued.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1908–9.										
1	1,800	2,060	3,760	....	20,400	33,100	16,600	3,500	2,300	2,480
2	1,900	2,230	4,480	....	21,600	35,600	16,300	3,100	2,480	2,320
3	1,900	1,950	3,850	....	23,300	34,700	14,000	3,050	2,300	2,380
4	1,760	2,110	3,430	....	24,200	32,800	12,300	2,990	2,180	2,320
5	2,000	2,170	2,890	....	28,300	32,300	11,000	3,640	2,420	1,530
6	1,800	2,060	2,480	....	38,500	30,900	13,500	4,120	2,480	2,020
7	1,760	2,060	2,960	....	55,100	31,200	20,900	4,300	2,550	2,020
8	2,230	1,520	3,270	....	73,300	33,400	20,400	4,250	2,480	2,140
9	2,420	2,110	4,030	....	73,500	34,100	13,800	4,030	2,720	2,140
10	2,290	1,900	4,030	....	63,200	33,100	11,900	3,760	2,320	2,200
11	2,170	2,000	4,580	....	51,600	32,500	12,200	3,760	2,380	2,580
12	2,230	2,170	6,000	....	42,900	34,000	9,470	3,810	2,140	2,520
13	2,000	2,350	5,370	....	38,800	34,500	9,410	3,330	2,940	3,100
14	2,110	2,350	6,220	....	57,700	34,100	9,330	3,170	3,330	2,940
15	2,060	1,850	5,170	....	85,200	31,500	7,300	2,900	2,720	2,750
16	2,000	2,060	5,070	....	90,400	28,100	6,600	3,020	2,550	2,520
17	1,850	2,110	4,970	14,400	86,100	27,000	12,400	3,100	3,670	2,380
18	1,630	2,480	....	12,700	81,500	29,500	12,000	2,940	5,410	2,220
19	2,000	2,750	....	11,200	77,200	33,100	12,500	2,690	5,580	1,580
20	2,000	2,610	....	9,900	75,000	33,700	9,820	2,450	4,360	2,320
21	1,800	2,540	....	8,660	70,700	31,900	12,100	2,320	3,500	2,350
22	2,000	1,900	....	8,020	64,200	29,200	10,000	2,450	3,020	2,480
23	1,950	2,610	....	7,780	61,900	25,400	7,000	2,580	3,140	2,180
24	1,900	2,000	....	8,100	56,700	22,500	6,770	4,070	2,800	2,080
25	1,480	2,110	....	10,100	49,300	20,400	6,670	5,300	2,870	1,850
26	1,950	2,680	....	19,900	42,800	18,800	6,380	3,330	2,650	1,310
27	1,900	2,820	....	18,300	38,000	17,700	4,250	2,520	2,520	1,630
28	2,110	2,610	....	18,600	35,100	15,000	3,670	2,320	2,720	3,470
29	2,350	2,000	....	19,500	34,700	15,400	5,200	2,480	2,020	5,830
30	2,350	2,110	....	19,300	32,700	17,100	5,240	2,690	2,520	6,950
31	2,420	....	....	19,600	....	16,900	....	2,690	2,870	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	8,790	3,670	5,720	....	11,600	67,700	53,700	24,400	18,200	5,720	2,060	2,380
2	9,060	3,940	5,100	....	11,000	82,200	53,200	15,800	18,100	5,410	2,940	2,450
3	7,180	3,760	4,690	....	10,800	76,300	51,000	20,300	18,900	4,440	3,170	2,520
4	6,720	3,760	4,690	....	11,600	67,900	43,800	21,200	18,000	4,210	3,050	1,580
5	5,830	3,500	4,590	....	10,400	57,400	41,900	23,600	16,300	4,210	3,500	1,210
6	5,410	3,300	....	....	10,500	47,600	38,900	26,500	17,700	4,550	10,600	1,980
7	5,620	2,610	....	....	....	43,500	36,400	26,400	21,200	4,120	9,190	3,670
8	5,370	3,500	....	....	....	47,000	37,400	22,900	22,200	3,990	7,060	4,030
9	4,830	4,210	....	....	....	43,700	39,100	20,400	21,000	3,530	6,160	5,830
10	3,020	4,170	....	....	....	35,200	39,800	17,600	19,000	3,170	4,440	5,100
11	3,330	3,940	....	....	....	29,900	31,300	17,300	18,000	2,940	4,360	3,760
12	3,940	4,030	....	....	....	25,200	30,000	17,200	22,100	4,120	4,400	3,870
13	3,710	3,940	....	....	....	23,500	24,600	16,600	24,100	4,030	4,590	4,400
14	3,580	3,330	6,950	....	....	24,200	21,400	14,900	20,700	3,530	4,030	4,300
15	3,500	3,850	6,270	....	....	21,900	18,300	13,800	15,900	3,100	3,360	3,990
16	3,200	3,990	5,300	....	....	20,500	18,200	13,800	14,900	2,940	4,120	4,440
17	2,140	3,670	4,950	....	....	19,200	14,700	12,700	13,900	2,060	4,120	3,940
18	2,870	3,670	4,890	....	....	16,800	14,600	12,300	14,800	2,080	4,030	2,550
19	3,420	4,030	4,500	....	....	15,800	17,600	11,700	13,100	2,300	4,210	2,140
20	3,250	3,810	....	....	....	15,300	19,000	12,000	13,400	2,750	3,990	3,170
21	3,170	2,320	....	....	....	20,900	18,700	12,000	12,200	2,870	3,870	3,500
22	3,300	3,250	....	46,300	....	25,400	18,200	14,100	10,000	2,940	3,760	3,020
23	3,300	3,760	....	57,700	....	26,800	18,500	10,200	8,970	2,580	4,440	3,100
24	2,800	3,760	....	41,200	....	31,500	20,400	12,100	7,900	1,830	4,030	2,900
25	3,710	3,990	....	33,300	....	36,600	23,400	11,200	7,060	1,430	4,250	1,850
26	4,630	4,210	....	27,200	....	56,800	27,000	11,900	7,950	2,260	4,170	1,550
27	5,370	5,200	....	23,100	....	58,600	34,300	17,800	4,250	2,610	3,300	2,140
28	4,440	5,520	....	19,100	....	52,600	33,700	25,000	5,830	3,170	1,900	2,380
29	4,300	6,160	....	17,500	....	50,800	31,400	24,900	5,410	2,940	1,850	2,650
30	3,940	6,380	....	14,800	....	53,700	28,000	23,000	6,160	3,100	2,450	2,520
31	3,300	....	....	11,400	....	54,800	....	19,900	....	2,140	2,800	....

nnecticut River at Sunderland, Mass., for the years
30, 1904–1915—Continued.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	22,500	48,500	5,830	4,400	4,590	8,150
....	15,800	52,600	6,050	2,720	4,590	7,180
....	12,500	54,800	6,050	1,850	4,400	6,950
....	12,500	51,600	4,990	1,530	4,400	4,030
....	11,000	45,900	5,830	1,960	3,850	3,020
....	12,500	39,800	6,270	2,200	2,200	4,790
....	34,300	31,100	6,490	2,450	2,200	5,200
....	50,800	22,500	7,900	2,320	2,870	4,400
....	50,800	21,000	6,720	1,530	3,170	5,830
....	41,900	20,300	8,920	1,330	2,870	11,600
....	34,300	19,900	6,050	2,200	2,450	7,900
....	32,300	18,900	3,670	3,020	2,200	6,490
....	32,700	18,200	9,470	2,720	1,280	6,050
....	38,100	18,500	9,190	2,720	1,110	5,410
....	50,100	13,100	8,150	2,580	1,960	5,620
....	59,300	12,800	7,420	1,330	1,960	5,200
....	64,400	11,900	6,270	1,280	2,200	3,850
....	48,900	11,000	6,720	2,200	2,080	6,490
....	41,500	12,500	6,950	2,320	1,960	5,830
....	39,400	9,760	6,270	2,450	1,130	5,620
....	38,100	8,920	5,620	2,200	1,130	5,620
10,600	37,600	8,920	5,830	2,200	1,850	5,410
11,000	35,100	7,660	5,830	1,430	1,850	4,400
9,760	30,700	7,420	5,200	1,230	2,200	2,870
8,660	33,500	6,490	3,330	2,080	2,200	2,800
10,600	35,600	6,270	2,450	2,450	3,330	3,330
6,720	38,900	6,950	4,590	2,720	2,450	4,990
36,400	39,800	4,790	4,590	3,020	2,720	4,990
30,700	48,500	3,100	4,400	2,580	3,850	4,590
31,100	50,800	4,400	4,790	1,960	5,620	5,410
27,600	....	6,270	....	3,020	7,900	....

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	46,800	32,300	48,500	2,450	2,720	4,210
....	55,100	28,000	51,600	5,200	3,500	3,330
....	48,500	24,100	51,200	5,200	3,850	5,200
....	36,400	21,000	51,200	4,400	2,720	6,050
....	29,100	21,000	45,400	1,960	2,080	6,050
....	38,500	11,600	38,100	2,320	2,870	5,620
....	60,700	19,200	31,900	1,740	3,670	5,620
....	75,800	20,700	28,300	1,740	3,670	4,790
....	79,600	20,300	25,200	4,030	3,670	4,210
....	68,800	20,700	15,100	4,030	3,500	4,790
....	57,200	19,200	17,100	3,670	3,330	5,200
....	49,700	17,800	14,400	3,850	3,330	4,790
....	44,600	18,900	13,100	4,030	4,990	4,790
....	43,200	19,600	13,100	2,720	5,200	4,400
....	41,900	19,900	12,500	2,450	4,990	3,020
....	45,000	20,700	11,900	2,870	5,200	6,050
....	59,300	33,100	7,660	2,450	5,410	11,000
....	63,800	40,200	10,000	2,450	4,030	9,470
....	64,900	32,700	8,920	3,170	5,200	9,190
48,500	66,300	26,800	8,920	4,400	6,050	8,660
44,100	61,400	24,800	8,150	3,020	5,830	12,500
33,500	55,100	29,900	7,420	2,720	4,790	13,500
26,400	50,400	36,800	4,790	3,020	4,030	17,100
22,200	50,800	32,700	6,490	3,330	3,670	17,100
17,800	49,300	27,600	6,950	3,500	3,170	13,800
16,100	47,600	24,100	6,720	4,400	2,720	9,760
14,800	44,100	19,200	6,490	4,400	3,170	7,900
13,800	39,800	19,200	6,490	3,020	3,670	6,950
19,600	33,100	16,800	6,050	2,580	4,990	7,180
41,500	34,300	21,800	2,720	2,450	5,620	5,410
43,200	....	42,400	....	1,960	6,490	....

Daily discharge, in second-feet, of Connecticut River at Sunderland, Mass., for the years ending Sept. 30, 1904–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	6,270	12,500	12,200	22,200	15,800	24,800	60,400	22,200	31,100	4,590	6,050	1,740
2	7,420	11,900	6,270	18,500	23,300	16,400	55,100	18,900	25,200	5,200	6,050	1,960
3	8,920	17,800	10,000	18,900	14,400	11,200	46,800	17,500	22,200	5,620	3,850	2,200
4	8,400	12,800	22,200	24,400	13,100	10,600	39,800	14,800	16,400	5,200	4,030	1,480
5	7,900	11,600	19,900	26,400	15,100	10,600	38,100	14,400	13,500	3,020	6,050	1,180
6	6,950	10,000	20,700	22,500	14,400	10,600	40,600	13,100	13,100	2,080	4,990	1,960
7	6,490	10,600	24,100	19,900	15,100	11,600	39,400	12,500	11,200	2,320	3,670	1,850
8	6,050	17,100	22,200	26,000	14,100	12,500	36,400	11,900	11,900	2,450	4,030	1,630
9	5,830	33,100	17,100	25,200	25,600	9,760	31,500	10,400	7,420	3,020	3,850	2,200
10	6,050	34,300	15,100	19,200	17,800	8,400	26,800	10,000	8,400	3,020	3,020	1,740
11	6,050	23,300	12,500	16,400	18,200	18,900	24,400	8,920	8,920	3,020	2,320	1,850
12	5,620	22,900	11,900	19,900	17,500	23,700	34,300	5,620	8,400	3,020	3,020	2,200
13	3,020	18,500	10,600	17,100	17,100	18,500	23,300	7,900	8,400	2,720	3,020	1,960
14	3,670	18,500	10,600	21,400	16,800	22,500	30,700	7,180	7,900	2,720	2,450	1,740
15	5,830	22,900	10,000	18,500	14,800	49,300	30,700	8,400	5,200	3,330	3,670	1,740
16	6,270	21,400	8,920	16,400	10,000	61,000	28,300	7,420	5,830	4,210	2,720	2,580
17	6,050	26,800	9,760	17,100	8,920	53,000	26,800	6,490	8,150	4,400	2,200	2,200
18	6,050	10,600	9,470	26,400	13,500	39,800	26,000	8,920	7,420	5,200	1,740	2,450
19	5,830	14,400	8,920	36,000	13,800	31,500	24,800	7,180	5,620	4,030	2,720	1,960
20	4,030	13,100	11,900	36,400	13,800	29,100	23,700	9,190	4,790	2,580	2,450	1,960
21	4,990	13,100	15,100	32,300	13,100	38,900	24,400	7,900	4,790	2,450	1,960	1,850
22	6,490	11,200	17,100	37,200	14,400	48,000	24,100	7,900	3,330	3,170	2,450	1,630
23	11,600	11,900	7,420	31,500	14,400	53,700	22,500	8,660	3,670	2,720	2,720	4,400
24	45,900	17,500	8,150	27,600	19,600	49,300	21,000	23,700	5,620	3,020	1,960	3,020
25	55,100	7,420	12,800	28,300	18,500	47,600	19,200	29,900	5,200	3,670	1,630	6,270
26	46,800	10,600	16,100	23,700	14,400	63,500	19,200	26,400	4,590	3,500	2,450	4,030
27	38,100	11,600	14,100	19,900	11,600	84,500	25,600	25,200	4,400	2,580	2,200	2,200
28	17,100	10,600	14,800	17,100	13,800	99,900	14,800	19,200	4,030	2,720	2,080	1,630
29	19,900	10,000	13,800	15,100	....	97,400	25,600	28,000	2,720	4,210	2,450	1,330
30	15,100	9,760	11,900	13,100	....	82,800	26,000	36,400	1,960	4,400	2,870	3,500
31	14,400	....	21,000	12,200	....	68,400	....	33,500	....	4,400	2,450	....

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.										
1	3,330	9,240	4,990	....	42,600	60,800	6,720	3,670	3,850	7,910
2	3,170	8,160	7,910	....	55,500	54,200	7,420	4,210	2,320	8,420
3	3,020	7,910	7,910	....	61,500	46,700	7,180	3,850	2,580	7,180
4	3,020	8,420	7,910	....	51,400	41,800	6,950	2,450	3,500	4,990
5	2,320	7,910	6,490	....	41,800	39,800	6,490	2,450	3,170	3,670
6	1,530	6,490	6,050	....	35,300	46,700	8,960	3,330	3,020	2,450
7	4,400	6,050	5,200	....	31,200	45,900	10,400	8,160	3,850	2,320
8	4,030	5,620	10,100	....	33,200	43,500	6,490	7,660	3,330	2,870
9	4,400	3,850	15,000	....	51,800	40,600	7,660	6,270	1,960	3,670
10	3,670	30,400	11,300	....	59,500	40,600	8,690	6,490	2,200	4,030
11	3,330	18,800	8,960	....	53,600	28,800	7,910	6,950	3,330	3,500
12	2,200	16,700	9,810	....	56,500	32,000	6,720	5,830	3,670	3,330
13	2,080	14,000	8,690	....	55,900	36,100	5,620	4,590	3,500	3,170
14	3,330	8,960	6,270	....	49,900	37,300	3,020	6,050	3,170	3,170
15	4,030	10,100	6,270	....	44,700	32,400	3,170	6,050	3,330	3,330
16	4,400	11,000	8,420	....	42,600	26,800	4,790	4,990	1,740	3,670
17	3,670	5,830	8,690	....	40,200	24,400	4,400	5,200	2,080	3,670
18	3,670	6,490	8,160	....	41,000	16,000	3,850	3,850	2,720	3,670
19	2,200	7,420	7,910	....	49,200	18,100	4,030	2,320	3,020	4,400
20	2,080	6,050	11,700	....	68,400	16,700	3,670	2,720	2,720	2,870
21	4,210	6,950	7,910	....	82,600	15,000	2,580	4,400	3,170	1,530
22	4,400	7,420	6,050	....	81,900	14,700	2,870	3,850	4,030	2,870
23	8,160	9,520	6,050	....	76,000	14,700	4,210	3,850	2,720	2,450
24	7,660	9,520	6,270	....	68,400	16,000	3,500	3,500	2,580	2,450
25	8,960	9,810	4,030	....	60,200	8,160	3,670	3,170	4,030	2,580
26	12,300	8,160	4,030	....	52,200	10,400	3,670	1,850	3,670	2,450
27	16,700	6,950	6,490	....	50,700	7,910	3,330	2,320	3,500	1,740
28	17,000	6,950	6,950	....	53,900	6,950	2,320	3,850	3,330	1,330
29	15,300	8,420	....	....	53,600	8,960	2,450	3,670	2,720	2,450
30	13,300	4,990	....	....	58,200	8,960	3,850	3,500	3,170	2,320
31	11,300	....	....	41,800	....	6,050	....	3,500	6,050	....

onnecticut River at Sunderland, Mass., for the years
. 30, 1904–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,050	42,600	7,660	22,100	6,490	3,670	13,300	8,960
,050	33,200	7,660	24,800	5,620	8,690	19,200	9,240
.830	28,800	6,950	24,000	4,590	16,000	14,300	9,520
,830	23,600	7,910	23,300	4,990	18,400	22,500	6,950
,830	18,100	8,160	18,400	5,200	17,800	55,800	3,020
,950	13,300	9,810	16,700	3,330	12,000	36,900	2,450
,660	14,700	9,810	13,600	3,330	14,300	27,600	4,210
,910	15,000	10,100	12,600	4,210	11,700	25,200	5,830
,420	12,600	15,000	12,000	3,330	64,900	18,100	5,410
,720	12,600	18,800	13,000	3,670	55,100	19,200	5,620
,830	12,300	34,400	12,600	3,500	45,800	18,800	4,790
,200	12,000	54,400	12,000	3,330	33,200	17,400	3,670
,590	11,300	57,900	11,000	1,740	35,300	18,800	4,030
,400	8,690	53,000	9,240	2,200	16,400	17,800	5,200
,210	8,160	43,800	8,420	3,170	13,300	16,000	5,200
000	8,960	37,700	7,420	3,670	15,300	12,000	4,400
100	8,160	32,400	8,420	4,400	14,700	13,300	4,400
800	8,690	26,400	8,420	5,200	16,000	12,300	4,400
700	8,960	24,000	6,490	6,270	9,240	10,400	3,170
600	7,660	22,500	8,420	4,400	13,300	7,910	2,870
700	5,620	21,000	10,100	5,410	20,300	7,180	4,400
960	6,720	19,500	8,960	6,950	16,400	7,910	7,180
240	6,950	17,000	3,330	8,420	14,000	24,000	7,180
520	6,950	19,500	4,400	5,830	14,700	14,700	6,490
300	8,420	11,300	7,180	4,590	14,000	16,700	7,180
800	11,300	8,960	7,910	5,200	9,520	18,100	7,180
000	13,600	14,700	6,720	2,720	6,270	16,700	6,490
500	10,700	20,300	6,050	2,450	18,800	15,300	6,270
....	10,700	21,000	6,720	4,030	10,400	8,160	6,490
....	10,700	22,500	4,400	3,670	13,300	10,100	8,420
....	9,520	....	3,170	....	13,300	11,300	......

l rating curves, which vary slightly but which are all well

1904, to Mar. 26, 1905; Feb. 7-27, 1906; Dec. 4, 1906, to Mar.
3, to Mar. 16, 1909; Dec. 6-13, 1909; Dec. 20, 1909, to Jan. 21,
1911; Jan. 11 to Mar. 19, 1912; Dec. 29, 1913, to Mar. 30, 1914,

er at Sunderland, Mass., for the years ending Sept.
0, 1904–1915.

area, 8,000 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
num.	Minimum.	Mean.	Per square mile.		
,000	22,900	38,700	4.84	5.40	B.
,200	14,200	31,600	3.95	4.55	A.
,200	4,080	8,100	1.01	1.13	A.
,820	2,500	4,530	.566	.65	A.
,280	2,310	5,120	.640	.74	A.
,800	3,140	8,540	1.07	1.19	A.
,500	8,180	13,400	1.68	1.94	B.
,600	5,720	7,510	.939	1.05	B.
,800	....	....	....	....	
,900	19,400	36,500	4.56	5.09	B.
,700	7,630	15,300	1.91	2.20	B.
,100	6,210	8,850	1.11	1.24	A.
,600	3,950	7,810	.975	1.12	A.
,100	4,130	9,390	1.17	1.35	A.
,900	7,140	19,600	2.45	2.73	A.

Monthly discharge of Connecticut River at Sunderland, Mass., for the years ending Sept. 30, 1904–1915—**Continued.**

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1905–6.						
October	9,610	5,660	7,480	0.935	1.08	A.
November	15,100	5,770	7,800	.975	1.09	A.
December	36,300	9,610	15,000	1.88	2.17	B.
January	52,200	12,100	19,400	2.42	2.79	C.
February	23,100		[a]10,700	1.34	1.40	D.
March	29,200	4,780	13,400	1.68	1.94	B.
April	72,300	18,400	36,100	4.51	5.03	B.
May	64,900	13,500	27,800	3.48	4.01	A.
June	35,500	8,690	16,600	2.08	2.32	A.
July	16,600	4,570	7,880	.985	1.14	B.
August	8,430	2,280	4,540	.568	.65	B.
September	5,520	1,850	3,070	.384	.43	B.
The year	72,300	1,850	14,200	1.78	24.05	
1906–7.						
October	7,650	1,630	4,430	.554	.64	B.
November	13,300	3,520	6,820	.652	.73	B.
December	7,650		[a]5,490	.686	.79	C.
January			[a]9,500	1.19	1.37	D.
February			[a]4,700	.588	.61	D.
March	61,000		[a]16,600	2.08	2.40	C.
April	62,400	18,000	32,600	4.08	4.55	B.
May	54,900	13,400	29,700	3.71	4.28	A.
June	20,400	6,220	11,500	1.44	1.61	A.
July	15,900	5,680	9,200	1.15	1.33	A.
August	9,540	2,230	5,000	.625	.72	A.
September	26,600	2,230	6,910	.864	.96	A.
The year	62,400	1,630	11,900	1.49	19.99	
1907–8.						
October	60,900	8,350	21,200	2.65	3.06	A.
November	70,000	11,700	27,900	3.49	3.89	A.
December	52,600	8,350	21,500	2.69	3.10	B.
January	27,000		[a]12,700	1.59	1.83	C.
February			[a]14,000	1.75	1.89	C.
March	63,300		[a]24,100	3.01	3.47	C.
April	54,400	21,900	32,600	4.08	4.55	B.
May	61,000	12,300	32,000	4.00	4.61	B.
June	24,700	4,120	10,300	1.29	1.44	A.
July	8,480	2,170	3,770	.471	.54	A.
August	8,350	2,680	4,690	.586	.68	A.
September	2,890	1,410	2,010	.251	.28	A.
The year	70,000	1,410	17,200	2.15	29.34	
1908–9.						
October	2,420	1,480	2,000	.250	.29	A.
November	2,820	1,520	2,210	.276	.31	A.
December	6,220		[a]3,710	.464	.53	B.
January			[a]6,000	.750	.86	C.
February			[a]12,000	1.50	1.56	C.
March	19,900		[a]14,700	1.84	2.12	C.
April	90,400	20,400	53,100	6.64	7.41	B.
May	35,600	15,000	28,400	3.55	4.09	A.
June	20,900	3,670	10,600	1.32	1.47	A.
July	5,300	2,320	3,250	.406	.47	A.
August	5,580	2,020	2,900	.362	.42	A.
September	6,950	1,310	2,550	.319	.36	B.
The year	90,400	1,310	11,700	1.46	19.89	
1909–10.						
October	9,060	2,140	4,420	.552	.64	A.
November	6,380	2,320	3,970	.496	.55	A.
December	6,950		[a]4,530	.566	.65	C.
January	57,700		[a]13,000	1.62	1.87	C.
February	11,600		[a]8,320	1.04	1.08	C.
March	82,200	15,300	40,300	5.04	5.81	B.
April	53,700	14,600	30,000	3.75	4.18	A.
May	26,500	10,200	17,500	2.19	2.52	A.
June	24,100	4,250	14,600	1.82	2.03	A.
July	5,720	1,430	3,260	.408	.47	B.
August	10,600	1,850	4,200	.525	.61	A.
September	5,830	1,210	3,100	.388	.43	B.
The year	82,200	1,210	12,300	1.54	20.84	

[a] Discharge relation affected by ice; estimates based on gage heights, discharge measurements, climatic data, and comparisons with records of other stations.

ver at Sunderland, Mass., for the years ending Sept.
904-1915—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
ximum.	Minimum.	Mean.	Per square mile.		
5,450	1,630	3,350	0.419	0.48	A.
9,470	1,630	4,950	.619	.69	A.
4,120	....	[a] 2,800	.350	.40	C.
....	....	[a] 10,000	1.25	1.44	D.
....	....	[a] 4,200	.525	.55	D.
36,400	....	[a] 8,960	1.12	1.29	C.
59,300	11,000	36,100	4.51	5.03	B.
54,800	3,100	19,500	2.44	2.81	A.
9,470	2,450	6,060	.758	.85	A.
4,400	1,230	2,260	.282	.33	B.
7,900	1,110	2,860	.358	.41	B.
11,600	2,800	5,470	.684	.76	A.
59,300	1,110	8,870	1.11	15.04	
49,300	4,790	16,300	2.04	2.35	A.
19,600	8,660	12,600	1.58	1.76	A.
33,900	7,900	18,000	2.25	2.59	A.
19,900	....	[a] 9,100	1.14	1.31	C.
....	....	[a] 4,500	.562	.61	C.
48,500	....	[a] 14,100	1.76	2.03	C.
79,600	29,100	51,400	6.42	7.16	B.
42,400	11,600	24,600	3.08	3.55	A.
51,600	2,720	18,900	2.36	2.63	A.
5,200	1,740	3,210	.401	.46	A.
6,490	2,080	4,130	.516	.59	A.
17,100	3,020	7,590	.946	1.06	A.
79,600	1,740	15,300	1.91	26.10	
55,100	3,020	12,800	1.60	1.84	A.
34,300	7,420	15,900	1.99	2.22	A.
24,100	6,270	13,800	1.72	1.98	B.
37,200	12,200	22,800	2.85	3.29	C.
25,600	8,920	15,500	1.94	2.02	C.
99,900	8,400	39,000	4.88	5.63	B.
60,400	14,800	30,300	3.79	4.23	A.
36,400	5,620	15,100	1.89	2.18	A.
31,100	1,960	9,050	1.01	1.13	A.
5,620	2,080	3,500	.438	.50	A.
6,050	1,630	3,130	.391	.45	A.
6,270	1,180	2,280	.285	.32	B.
99,900	1,180	15,300	1.91	25.79	
17,000	1,530	5,910	.739	.85	A.
30,400	3,850	9,270	1.16	1.29	A.
15,000	4,030	7,530	.941	1.08	A.
....	....	[a] 3,650	.456	.53	D.
....	....	[a] 3,170	.396	.41	D.
....	....	[a] 15,300	1.91	2.20	D.
82,600	31,200	53,400	6.68	7.45	B.
60,800	6,050	27,300	3.41	3.93	A.
10,400	2,320	5,220	.652	.73	A.
8,160	1,850	4,340	.542	.62	A.
6,050	1,740	3,160	.395	.46	A.
8,420	1,830	3,480	.435	.49	A.
82,600	....	11,800	1.48	20.04	
3,500	1,400	2,510	.314	.36	B.
6,950	1,290	3,390	.424	.47	B.
7,660	1,290	4,330	.541	.62	B.
13,000	1,960	5,960	.745	.86	C.
74,700	4,210	15,700	1.96	2.04	C.
42,600	5,620	13,200	1.65	1.90	B.
57,900	6,950	22,100	2.76	3.08	B.
94,800	3,170	11,000	1.38	1.59	A.
8,420	1,740	4,400	.550	.61	A.
54,900	3,670	18,900	2.36	2.72	A.
55,800	7,180	17,600	2.20	2.54	A.
9,520	2,450	5,690	.711	.79	A.
74,700	1,290	10,400	1.30	17.58	

ates based on gage heights, discharge measurements, climatic stations.

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CONNECTICUT RIVER AT HOLYOKE, MASS.

Location.—At the dam of the Holyoke Water Power Co. at Holyoke.

Drainage area.—8,390[1] square miles.

Records available.—January 1, 1880, to December 31, 1899.

Determination of discharge.—Discharge determined by adding the water wasting over the dam to the flow through the canals of the power company. Flow over dam determined by taking the mean of the flow for the 12-day hours and the flow for the 12 night hours; flow in canals obtained by weighting the flow during the day of 10 hours and the flow during the night of 14 hours. Record does not show the effect of storage above the dam but gives the flow below Holyoke.

Extremes of discharge.—Maximum 24-hour flow recorded 1880–1899: 115,000 second-feet, April 16, 1895. Minimum 24-hour flow recorded: No flow at various times when water was being stored above the dam.

Cooperation.—Record of daily discharge furnished by the Holyoke Water Power Co. through A. F. Sickman, hydraulic engineer. Monthly and yearly discharge computed by engineers of the Geological Survey.

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years ending Sept. 30, 1880–1899.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1880.									
1	7,300	24,650	31,700	7,300	23,900	8,750	2,300	1,800	2,050
2	7,750	18,900	29,000	8,050	22,650	8,600	1,950	2,150	2,050
3	8,300	14,350	24,300	10,700	21,900	8,150	3,100	2,150	2,050
4	7,750	12,700	23,050	21,400	20,250	7,050	4,500	2,150	2,050
5	7,600	11,550	28,850	35,900	17,700	6,100	6,150	4,550	0
6	8,450	10,900	40,150	44,100	15,450	5,700	8,300	4,650	1,750
7	8,800	10,200	35,950	42,800	14,700	5,600	6,750	3,950	1,750
8	8,800	9,100	27,600	36,650	14,800	5,400	5,400	2,850	1,750
9	8,450	8,050	22,050	30,160	14,600	5,300	4,400	2,150	1,750
10	8,450	7,300	17,950	31,800	12,750	4,900	4,200	2,150	1,750
11	7,750	7,450	15,050	20,350	11,650	4,500	2,950	2,150	1,750
12	7,550	7,650	12,900	17,100	11,100	4,450	3,100	2,150	0
13	7,500	9,400	11,800	15,000	11,500	4,200	3,650	2,150	1,650
14	7,350	16,350	11,550	13,750	10,800	3,600	5,350	2,150	1,650
15	7,050	22,950	10,800	13,300	10,350	3,700	4,600	1,250	1,650
16	7,050	21,850	10,300	14,250	9,800	3,800	3,850	2,050	1,650
17	6,950	18,350	10,050	19,800	7,350	4,000	3,700	2,050	1,650
18	6,600	16,450	9,550	23,750	8,350	3,750	2,750	2,050	1,650
19	6,550	22,750	8,950	20,900	7,950	3,550	2,700	2,050	350
20	6,650	24,850	9,050	19,950	8,300	3,100	2,450	2,050	2,350
21	6,900	21,600	8,300	18,800	8,300	2,400	3,250	2,050	2,350
22	7,000	17,700	8,500	17,400	8,050	2,300	3,600	300	2,350
23	7,700	15,500	8,350	17,550	8,150	2,150	3,250	2,050	2,350
24	9,750	13,800	8,300	18,900	8,450	2,000	3,450	2,050	2,350
25	9,800	11,750	7,950	18,200	8,800	1,850	3,000	2,050	2,350
26	9,400	10,950	7,350	16,550	8,350	1,800	2,550	2,050	0
27	8,950	11,250	7,400	15,000	7,500	1,750	2,500	2,050	2,000
28	15,700	12,650	7,100	14,500	6,450	1,950	2,450	2,050	2,000
29	22,950	19,450	6,900	15,250	6,000	2,150	2,300	0	2,000
30	23,550	....	6,850	19,800	5,650	2,100	2,200	2,050	2,000
31	24,700	....	6,950	....	6,350	....	2,100	2,050	....

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[1] Remeasured since published in previous reports.

cut River at Holyoke, Mass., for the years ending
-1899—Continued.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
950	12,050	9,200	36,400	11,450	6,000	4,950	2,950
,950	17,600	9,500	32,400	10,350	5,700	5,000	2,950
,950	17,300	9,450	29,600	9,800	5,700	5,500	2,950
,950	15,800	9,350	25,450	9,400	5,600	5,950	2,800
,950	14,500	8,850	24,400	7,750	5,150	4,950	4,650
0	12,500	8,550	20,100	7,400	4,200	3,850	4,750
,600	11,650	8,550	20,300	6,800	4,750	3,000	4,800
,600	11,450	7,750	19,800	6,700	4,050	4,150	4,050
,600	11,650	8,500	19,250	6,550	3,500	4,100	3,600
,600	14,250	10,600	19,200	6,750	2,850	5,050	3,000
,600	17,450	13,500	20,000	8,050	2,950	7,050	2,600
,600	17,750	17,900	25,200	8,050	2,950	6,650	3,100
,250	16,650	19,000	30,850	7,150	2,950	5,200	3,100
,050	15,100	17,600	32,850	6,300	2,950	4,250	3,100
,850	14,300	17,400	32,050	6,350	2,950	4,100	3,100
,350	15,100	17,600	36,650	6,550	2,950	3,300	3,100
3,400	15,850	17,950	45,750	5,900	1,000	3,100	3,100
7,500	15,150	20,000	49,050	5,200	2,950	3,100	0
6,450	11,700	22,400	45,400	4,450	2,950	3,950	2,700
5,400	14,200	23,700	42,700	4,550	2,950	3,800	2,700
5,400	14,450	25,100	39,550	4,000	2,950	2,300	2,700
5,200	19,500	29,300	31,200	3,750	2,950	3,050	2,700
5,050	14,400	33,150	27,000	3,750	2,950	3,050	2,700
5,250	13,100	36,500	24,100	3,750	1,700	3,050	2,700
3,500	11,950	47,250	20,500	3,600	3,100	3,050	450
3,600	11,000	48,500	17,650	3,200	4,700	3,050	2,950
4,550	9,850	45,600	15,550	3,850	7,300	3,050	2,950
3,300	9,350	44,050	14,800	4,400	7,600	450	2,950
.....	9,150	43,400	13,500	5,500	6,100	2,950	2,950
.....	9,150	41,950	12,700	5,000	5,350	2,950	2,950
.....	9,150	....	12,350	....	2,850	2,950	....
7,450	10,500	17,650	16,150	29,850	4,800	3,500	2,400
7,500	24,850	15,350	15,150	30,850	5,600	3,550	2,400
7,100	40,450	16,850	14,650	30,300	6,450	3,650	250
6,400	43,650	18,700	14,550	28,250	6,600	3,400	2,850
5,350	36,500	21,550	14,650	33,650	7,550	2,450	2,850
5,600	30,950	23,500	14,050	35,300	8,200	800	2,850
5,050	30,700	23,500	13,150	30,050	9,250	3,000	2,850
4,950	26,800	22,150	12,700	25,950	8,750	3,050	2,850
4,900	22,000	21,850	13,100	21,550	7,400	3,000	2,850
4,900	22,650	23,200	14,350	18,950	6,600	3,300	850
5,000	25,350	21,900	15,850	16,750	5,950	3,450	2,900
4,400	22,200	19,650	19,350	16,550	5,850	2,600	3,250
4,950	19,450	16,850	22,900	15,200	5,600	1,300	3,500
5,380	16,850	15,100	23,900	13,450	5,900	3,650	3,350
7,550	14,550	13,550	25,850	11,500	6,950	3,550	3,250
12,350	13,300	12,100	28,000	11,600	6,750	3,400	2,550
14,400	12,250	11,400	24.500	11,600	6,200	3,450	2,050
22,000	11,700	12,350	20,800	10,800	5,850	3,500	3,450
19,200	10,650	14,400	18,300	12,600	4,850	2,750	3,400
16,650	11,200	21,300	17,250	17,150	4,750	1,200	3,500
13,900	11,950	25,800	16,850	16,450	4,400	3,400	3,100
11,000	13,000	25,150	18,900	15,450	4,150	3,200	3,400
9,800	12,250	22,700	20,200	13,950	3,500	2,950	10,900
10,250	11,150	20,950	23,200	12,500	3,650	3,000	45,000
10,450	10,500	17,600	23,900	9,900	3,500	3,200	39,250
9,750	8,950	15,300	22,450	8,700	3,400	2,550	26,950
9,500	9,100	13,500	20,350	8,150	3,500	250	20,150
9,200	15,600	13,100	18,950	7,300	3,600	2,400	15,000
....	23,400	13,850	30,900	6,550	3,150	2,400	11,400
....	22,300	14,700	38,500	5,750	1,600	2,400	9,100
....	20,150	....	38,500	....	3,550	2,400	....

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years endin Sept. 30, 1880–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1882–83.												
1	6,800	3,800	3,000	3,250	3,400	5,250	7,550	15,200	16,200	4,450	3,050	2,5
2	6,600	3,750	2,450	3,700	3,650	4,800	7,700	14,700	16,100	4,400	3,200	2
3	6,050	3,750	850	3,350	2,850	4,100	8,200	14,800	14,150	4,400	3,850	2,2
4	5,600	3,150	2,950	3,050	2,150	4,250	9,000	15,650	13,000	3,900	4,000	2,2
5	5,400	3,100	3,000	3,100	3,650	4,800	9,900	16,550	11,450	5,000	3,950	2,2
6	4,900	3,750	2,900	2,450	3,600	4,950	13,800	19,850	10,600	6,550	4,100	2,2
7	4,250	3,200	2,850	400	3,400	4,850	21,450	28,250	10,000	6,500	3,650	2,2
8	3,700	3,000	2,850	2,800	3,600	4,700	19,650	29,350	9,850	7,100	3,750	2,2
9	4,400	3,450	2,350	2,800	3,600	4,350	19,700	28,550	9,400	8,550	3,400	2
10	4,200	3,750	1,250	2,800	3,200	3,400	24,700	25,750	8,600	8,100	3,450	1,9
11	4,200	2,800	2,950	2,800	3,200	3,150	33,950	24,500	8,600	7,850	3,200	1,9
12	4,300	1,700	3,250	2,800	3,650	3,600	41,350	24,250	8,450	7,600	2,450	1,9
13	4,350	3,850	3,500	2,800	3,550	3,550	59,450	21,600	10,600	7,200	3,650	1,9
14	4,400	3,700	3,650	900	3,600	3,700	68,300	19,950	13,150	7,750	3,300	1,9
15	5,300	3,650	3,600	2,850	3,500	3,750	67,150	18,550	16,100	5,950	3,250	1,9
16	5,100	3,650	2,750	2,850	3,500	3,750	67,050	18,100	17,200	6,600	3,200	25
17	4,100	3;700	850	2,950	2,750	3,650	63,400	17,100	13,950	7,050	3,350	2,15
18	4,050	3,700	3,050	2,950	3,050	3,600	60,300	15,500	11,550	6,800	2,650	2,15
19	4,150	3,750	2,950	2,900	4,650	4,850	57,300	14,350	9,900	7,400	950	2,15
20	4,400	3,750	3,050	2,400	5,150	6,300	56,200	12,500	9,550	7,350	2,900	2,15
21	4,750	3,700	3,050	800	5,650	7,550	56,500	12,200	10,450	6,450	2,850	2,15
22	4,700	3,600	3,200	2,950	5,750	7,250	45,800	14,700	11,750	5,150	2,750	2,15
23	5,050	3,700	2,500	2,950	5,400	6,550	36,550	24,150	11,350	4,950	3,050	25
24	4,800	3,600	1,250	2,900	4,750	5,950	27,900	29,100	10,050	4,650	3,100	2,30
25	4,500	2,850	2,850	2,850	4,550	5,900	24,300	26,200	9,200	3,900	2,350	2,30
26	4,250	1,050	3,450	2,950	4,600	6,050	20,900	22,650	8,050	3,950	1,000	2,30
27	4,100	3,700	3,450	2,400	4,700	6,600	18,900	19,950	6,850	3,500	2,850	2,30
28	3,600	3,750	3,550	1,000	5,000	7,500	18,150	17,950	6,000	2,600	2,700	2,30
29	3,500	3,650	3,700	2,950	....	8,300	,17,000	15,350	5,800	1,750	2,850	2,30
30	3,800	2,400	2,500	3,000	....	8,400	16,400	14,500	5,000	3,350	2,750	90
31	3,500	....	1,350	3,000	....	8,050	....	15,000	....	3,300	3,200	....
1883–84.												
1	2,900	7,000	6,250	8,150	5,450	9,500	34,850	35,450	15,500	6,200	4,050	5,45
2	3,050	6,250	4,950	7,500	5,450	8,900	30,150	33,750	14,450	4,900	3,200	4,50
3	3,700	6,000	3,850	7,450	5,600	8,850	26,600	32,200	13,150	3,000	1,000	4,40
4	4,650	5,450	3,650	7,000	5,700	8,500	24,850	29,950	12,100	4,250	3,500	4,05
5	4,500	5,700	3,800	6,550	5,650	8,350	23,300	30,000	11,250	4,400	3,500	3,75
6	3,650	5,150	4,050	5,850	5,850	8,100	21,000	29,850	10,550	4,600	3,500	3,20
7	3,050	4,650	3,900	5,650	8,050	7,900	20,400	29,900	9,600	5,000	3,500	1,10
8	3,650	4,400	3,900	5,100	10,700	7,600	20,800	28,550	8,750	4,600	3,500	3,05
9	3,650	4,050	4,100	5,950	11,350	7,300	24,000	26,700	8,550	4,350	3,500	3,05
10	3,300	3,800	5,000	8,750	10,650	7,300	28,000	24,250	9,250	4,100	1,150	3,05
11	3,400	3,700	4,900	8,800	10,800	7,300	30,750	22,950	12,700	4,050	3,600	3,05
12	3,400	4,400	4,900	8,150	10,300	7,550	33,600	23,600	12,600	4,350	3,600	3,05
13	2,600	4,300	4,550	7,200	9,950	11,850	25,700	23,150	12,000	4,200	3,600	3,05
14	950	4,250	4,700	7,350	11,200	17,300	36,650	22,800	10,950	4,100	3,600	55
15	4,050	4,150	3,750	6,850	15,550	18,950	37,750	25,600	9,100	3,950	3,600	2,70
16	3,800	4,050	2,900	6,100	19,350	17,150	45,750	25,700	8,500	4,000	3,600	2,70
17	3,500	3,250	3,450	5,700	18,300	15,100	62,100	25,250	8,200	4,150	1,000	2,70
18	3,300	2,650	3,450	5,350	20,550	13,750	66,850	26,100	7,350	4,800	2,800	2,70
19	3,400	3,450	3,400	5,150	25,900	13,100	70,800	27,200	6,950	4,250	2,800	2,70
20	2,500	3,400	3,350	5,200	27,200	12,950	69,500	25,800	6,700	4,300	2,800	2,70
21	1,850	3,450	3,500	5,200	28,100	13,150	66,850	26,050	6,200	4,350	2,800	50
22	3,200	3,450	2,750	4,950	26,200	13,000	60,950	27,050	6,000	4,350	2,800	2,65
23	3,350	3,650	1,550	5,250	24,250	14,250	53,350	27,700	5,850	4,000	2,800	2,65
24	3,350	4,600	3,100	5,400	20,950	21,750	46,800	27,650	5,650	4,100	1,350	2,65
25	3,300	5,300	1,800	5,650	18,150	35,250	41,900	27,650	5,050	4,150	3,650	2,65
26	3,250	6,750	3,000	5,900	15,350	49,500	39,200	26,500	5,450	3,950	3,650	2,65
27	2,750	8,600	2,950	5,750	13,500	71,350	38,150	24,300	5,650	4,200	3,650	2,65
28	2,650	10,100	3,500	5,600	12,450	71,900	39,350	22,000	5,700	4,900	3,650	950
29	3,600	8,350	4,350	5,300	11,100	71,550	39,200	20,800	7,200	5,100	3,650	2,900
30	7,050	7,700	5,250	4,850	....	58,850	37,950	19,950	7,200	4,600	3,650	2,950
31	8,350	....	6,650	4,850	....	45,450	....	17,550	....	3,900	5,800	....

ticut River at Holyoke, Mass., for the years ending
0–1899—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
7,300	5,250	8,500	33,550	7,500	7,550	2,950	8,150
8,700	5,100	11,100	29,100	9,000	5,650	4,250	6,950
7,700	5,150	14,050	25,250	8,050	5,100	5,000	6,500
8,050	5,450	25,950	22,800	9,200	9,000	6,150	6,250
7,900	5,550	29,050	20,200	10,250	9,050	6,650	5,950
7,750	5,550	31,450	18,350	17,600	8,500	7,450	4,450
7,750	5,400	30,700	16,800	17,600	7,850	7,800	6,300
7,850	5,050	35,650	16,500	14,550	7,750	6,500	6,600
7,250	5,250	40,150	20,450	13,200	8,500	4,450	5,750
8,000	5,050	41,250	23,300	11,150	9,700	5,550	6,050
9,000	5,100	37,400	23,450	9,300	9,850	5,350	7,100
9,150	4,950	32,900	22,200	7,850	10,500	4,850	7,750
8,900	4,850	29,150	20,450	6,400	11,750	4,300	6,950
8,850	4,600	25,950	18,500	5,350	12,050	4,600	7,350
8,150	4,350	26,700	16,450	5,100	11,100	12,850	6,850
7,200	4,500	30,300	15,000	4,650	10,050	13,550	6,700
6,500	4,300	33,550	13,800	4,300	10,150	10,750	6,300
6,500	4,400	34,400	14,150	3,800	9,100	8,050	5,700
6,300	4,300	35,800	13,950	3,550	7,800	6,100	4,800
6,200	4,300	39,850	13,550	3,400	5,850	4,850	4,100
6,700	3,950	46,550	12,850	3,800	4,950	4,050	4,250
6,950	4,000	56,750	12,000	4,150	5,050	3,550	4,150
6,000	4,150	62,800	11,100	5,000	4,250	5,950	3,850
5,700	3,650	63,950	10,850	3,850	3,900	6,750	3,050
5,500	3.600	60,900	11,550	3,550	3,700	5,950	3,300
5,500	3,700	54,400	11,300	3,500	3,900	5,800	4,150
5,450	4,700	51,500	10,800	3,100	3,650	5,900	4,500
5,250	5,450	47,350	9,600	3,300	3,200	5,300	4,750
....	5,700	43,850	8,850	4,050	3,300	4,900	4,650
....	5,600	41,050	8,150	4,100	3,000	5,200	4,350
....	6,150	....	7,100	....	2,950	5,400	....
13,450	14,350	59,950	14,300	12,900	4,350	2,450	2,500
12,200	14,700	80,150	13,700	11,200	3,300	3,300	2,850
11,150	11,450	69,650	13,300	11,150	3,450	3,050	3,000
11,500	9,600	51,500	12,500	10,500	3,300	2,950	2,250
11,050	8,250	37,500	11,750	9,950	3,050	3,200	600
8,750	7,650	34,150	11,700	10,550	3,900	3,100	2,500
7,400	7,300	37,950	11,500	10,900	3,250	2,300	2,450
7,250	7,400	32,050	12,050	10,250	3,100	1,450	2,500
7,200	7,300	27,450	19,600	8,850	3,000	2,900	2,550
7,200	7,100	26,450	18,250	8,000	2,150	2,800	2,500
7,400	6,850	28,150	16,700	7,500	850	2,900	1,650
9,000	6,800	27,700	17,550	6,800	3,150	2,900	50
14,300	6,700	28,150	16,400	6,500	2,800	2,900	2,100
22,250	6,700	35,000	14,250	6,200	2,800	2,050	2,100
30,300	7,050	41,250	12,250	6,350	2,750	550	2,100
36,650	7,800	43,950	11,800	6,600	2,900	2,650	2,100
37,500	8,450	43,250	13,850	7,800	2,300	2,550	2,100
32,950	8,800	42,400	13,350	7,150	2,500	2,550	2,100
26,150	9,250	42,650	12,150	6,600	3,950	2,600	50
21,500	9,200	42,800	12,200	5,850	3,950	2,950	2,700
17,150	9,150	42,250	11,650	5,800	3,700	2,700	2,700
14,650	9,800	40,350	10,250	6,050	3,800	3,650	2,700
13,300	9,650	37,400	8,850	5,950	3,250	3,950	2,700
12,350	8,500	33,750	8,500	5,850	2,800	3,600	2,700
10,650	8,350	29,350	8,200	5,450	2,100	3,200	3,200
11,100	8,650	25,950	7,500	4,700	3,150	3,150	3,350
18,350	9,800	22,500	7,950	4,850	3,100	3,150	3,650
17,000	10,700	19,750	10,400	5,150	3,200	2,350	3,450
....	13,050	17,600	14,250	4,900	3,050	1,050	4,350
....	14,600	16,550	15,150	4,550	3,150	2,650	5,100
....	22,750	....	14,700	....	2,500	2,500	....

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years endin Sept. 30, 1880–1899—**Continued.**

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1886–87.												
1	6,150	10,300	18,250	9,700	31,900	8,300	8,750	72,500	17,100	9,350	12,950	8,3
2	8,850	9,950	21,050	9,950	25,250	8,250	8,150	62,550	17,250	7,900	12,300	8,5
3	8,800	8,750	17,700	10,250	20,200	8,150	8,100	57,400	16,850	6,750	14,200	6,6
4	8,050	7,550	12,500	10,150	17,550	7,850	9,650	56,500	16,750	5,750	12,700	6,1
5	6,850	6,800	7,400	9,250	15,200	7,350	14,600	57,550	17,750	6,200	10,350	6,3
6	6,100	5,850	6,150	8,750	13,600	7,200	18,650	54,900	16,900	6,150	8,800	6,2
7	5,500	6,150	8,300	8,250	13,450	7,400	21,500	51,400	14,700	7,650	10,100	6,1
8	4,100	8,400	8,600	7,750	12,700	7,300	22,400	48,850	12,700	9,050	11,250	6,5
9	3,550	9,750	9,050	7,750	12,300	7,300	21,700	48,250	11,200	8,500	11,300	6,7
10	3,300	10,000	9,550	7,450	12,100	7,700	30,300	44,500	9,850	8,200	10,250	6,5
11	3,700	9,800	9,350	7,350	12,950	7,900	65,000	37,000	8,600	8,550	9,500	6,1
12	3,450	9,450	9,300	7,350	13,200	7,300	85,500	36,200	7,950	8,950	9,150	6,0
13	3,250	8,900	9,600	7,650	14,000	7,250	77,650	32,700	8,100	9,100	7,850	6,1
14	3,200	8,000	9,700	7,850	13,850	7,600	59,300	29,200	7,550	9,500	7,150	6,4
15	3,250	7,800	9,650	7,400	12,350	7,900	50,700	24,900	6,550	8,850	6,500	6,6
16	2,400	7,750	8,800	7,950	12,200	7,650	48,250	21,950	6,100	7,250	6,250	6,2
17	1,100	7,550	7,400	7,200	12,500	7,600	48,450	18,850	5,850	6,400	5,650	5,5
18	3,300	12,500	6,850	6,650	12,350	7,600	48,350	16,800	5,300	6,600	9,950	5,1
19	3,350	24,850	7,650	6,800	13,150	7,200	41,350	15,700	5,150	6,450	16,000	4,8
20	3,250	34,800	8,950	7,550	13,700	7,700	35,750	14,900	5,300	5,850	13,050	4,8
21	3,300	29,050	8,750	7,600	12,900	8,650	35,350	13,450	5,500	5,550	10,800	4,8
22	3,200	25,450	8,300	7,150	11,850	9,600	40,950	11,700	5,650	5,650	9,900	4,6
23	2,450	22,100	8,100	7,250	10,800	9,550	50,150	11,600	8,250	6,250	14,150	4,3
24	1,000	28,200	8,000	8,500	10,150	9,300	58,300	10,750	22,500	15,150	19,750	3,7
25	3,250	26,950	9,300	14,750	9,600	9,150	70,050	10,050	27,650	32,300	26,750	3,6
26	3,300	23,800	12,450	19,450	8,100	8,500	70,850	10,150	26,000	26,850	23,150	3,6
27	3,350	21,400	14,950	21.600	7,800	8,400	67,850	11,650	22,700	26,250	17,650	3,8
28	3,600	18,500	14,050	19,050	8,250	9,100	63,550	15,900	18,200	21,950	13,300	3,7
39	6,550	16,450	12,250	20,100	....	9,900	70,350	22,350	14,300	17,800	11,200	3,8
30	6,450	15,400	11,150	36,900	....	9,550	78,800	24,050	11,350	16,250	9,800	3,7
21	7,500	....	9,950	39,150	....	8,850	....	20,050	....	15,100	8,950	.....
1887–88.												
1	3,300	4,450	17,000	7,650	7,250	9,050	36,400	99,750	16,400	7,600	3,000	6,85
2	3,600	4,450	12,700	9,800	7,350	8,550	37,400	93,550	15,000	7,000	3,000	8,60
3	4,150	4,250	8,850	12,950	7,650	7,750	40,850	79,800	13,550	5,800	3,300	8,45
4	4,250	4,200	7,400	13,750	7,400	7,250	39,300	67,950	13,750	5,800	2,550	7,05
5	4,600	3,550	8,700	13,550	7,500	7,400	35,550	59,100	13,050	5,650	1,100	6,95
6	4,550	3,500	10,550	12,350	6,850	7,300	43,550	51,300	11,950	5,700	3,100	6,50
7	4,400	3,800	11,700	10,950	7,150	7,000	54,300	49,850	11,400	5,300	3,100	5,75
8	3,900	3,750	11,100	10,300	7,600	6,750	50,550	49,350	11,400	4,750	3,250	4,90
9	4,050	4,200	10,250	10,100	7,200	6,400	40,600	47,250	10,950	4,350	3,450	6,20
10	4,150	4,050	9,200	9,400	7,250	6,150	34,600	52,350	10,300	4,250	3,450	8,50
11	4,050	3,550	11,250	8,350	6,600	6,200	32,400	55,200	10,400	4,100	2,450	7,55
12	4,400	3,500	24,700	8,100	7,350	6,300	31,250	65,150	9,850	3,550	1,650	7,10
13	4,250	4,500	27,600	7,850	7,050	5,650	30,350	71,250	8,950	3,700	4,200	6,70
14	4,250	4,600	23,850	7,300	6,700	5,900	30,500	71,400	8,150	2,900	6,750	6,45
15	3,750	4,800	20,550	7,350	6,800	6,050	28,150	75,650	8,500	4,400	6,750	5,65
16	3,650	6,450	18,450	7,900	6,850	6,400	27,150	73,000	8,300	3,650	5,750	5,05
17	3,750	7,650	15,150	8,600	7,100	6,350	28,300	62,300	7,650	4,150	5,300	4,95
18	3,750	7,550	12,400	8,950	7,150	6,400	31,100	51,400	7,900	5,350	4,800	10,20
19	3,850	7,050	11,350	8,800	7,350	6,450	31,950	42,250	7,700	4,900	5,500	14,75
20	3,700	7,850	9,900	8,650	7,050	6,550	34,150	34,850	7,000	4,750	5,950	13,50
21	4,200	10,450	9,350	8,000	8,300	8,000	35,750	29,800	6,300	3,700	5,500	24,35
22	5,150	9,950	9,450	8,100	11,800	15,150	34,100	26,100	6,450	3,600	6,000	42,00
23	5,950	9,100	10,100	7,300	13,800	22,600	34,300	23,400	6,600	3,750	6,300	34,00
24	6,200	7,750	7,450	7,100	14,100	25,300	34,650	21,350	6,700	3,500	6,050	26,60
25	6,200	7,500	6,700	7,150	12,750	24,150	32,750	20,100	12,900	3,550	5,300	20,65
26	6,100	7,500	6,100	7,250	11,800	21,950	31,700	18,250	17,600	3,600	4,900	18,05
27	5,700	7,850	6,650	7,000	11,750	19,950	35,300	16,750	14,700	3,500	4,750	19,35
28	5,400	11,450	6,700	6,850	10,650	19,000	48,200	16,700	12,400	2,650	5,300	18,75
29	4,700	15,250	7,800	8,000	9,700	20,500	70,100	18,550	11,050	1,600	6,950	17,75
30	4,400	18,700	8,250	7,250	....	25,750	90,900	19,900	9,050	3,400	8,150	16,40
31	4,500	....	7,700	7,000	....	32,400	....	18,050	....	3,150	7,650	.....

cut River at Holyoke, Mass., for the years ending
***–1899*—Continued.**

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,100	5,750	16,300	29,050	9,200	10,850	18,550	2,450
,950	5,950	16,100	25,150	18,800	9,800	20,850	3,350
,000	5,750	15,900	21,350	21,150	9,700	21,050	3,900
,850	6,150	15,750	18,000	17,600	10,050	19,100	3,450
,200	7,500	18,150	15,750	14,650	9,850	16,300	3,100
,750	11,050	19,550	14,650	12,800	9,050	16,400	3,500
,850	14,450	19,950	13,200	12,100	8,000	14,250	2,700
,950	15,000	20,950	12,400	11,900	8,000	11,550	1.350
,900	13,800	23,950	11,750	12,900	7,300	9,850	3,250
,950	12,200	26,250	11,450	15,300	6,650	8.650	3,400
,550	11,900	27,750	11,000	17,900	6,900	8,150	3,650
,300	11,000	29,150	10,600	21,750	7,700	8,500	3,650
,200	10,500	32,300	10 600	20,600	7,450	8,600	3,650
,050	11,150	31.600	9,950	18,500	6,550	9,050	2,350
,100	11,650	28,050	9,600	16,100	6,500	9,600	2,100
,600	10,750	24,800	9,500	13,200	7,200	9,300	3,850
,700	10,200	22,750	9,300	13,000	7,050	7,900	3,300
7,300	11,250	23,700	9,100	12,500	6,250	6,950	6,550
7,400	13,400	27,650	8,500	13.600	5,750	6,550	8,400
7,350	16,700	33,000	8,800	13.300	9,500	6,250	9,000
7,000	17,250	36,650	11,000	11,400	14,350	5,800	11,750
,900	16,650	37,800	18,900	9,400	15,000	5,300	14,200
,050	16,900	35,350	21,300	7,750	12,800	5,200	17,450
5,700	18,350	31,950	19.100	7,550	10.500	4,650	13,750
5,950	13,550	28,800	17,550	7,000	8,950	4,400	11,350
5,950	24,600	25,250	14,400	6,300	7,700	4,550	9,450
5,800	21,750	26,150	12,850	6,500	7,050	4,450	7,750
5,600	19,850	32,400	11,900	8,000	7,800	4,200	6,150
.....	20,050	34,300	11,550	10,500	8,500	3,900	5,700
.....	19,250	31,600	10,650	10,850	11,350	3,800	7,250
.....	17,300	....	9,300	....	18,500	2,700	....
8,550	37,250	14,650	24,950	20,200	7,450	4,000	17,750
8,750	32,350	13,650	23,900	17,800	6,250	2,800	17,050
9,000	23,850	13,600	24,250	15,750	5,300	3,350	15,100
9,250	18,650	17,950	23,800	14,350	5,400	3,800	12,350
1,900	16,750	34,250	25,450	13,650	6,600	3,700	10,000
18,000	14,400	41,850	31,700	19,650	7,100	3,700	7,950
17,050	11,200	38,050	42,300	25,950	7,100	3,700	9,200
15,600	9,650	37,750	46,750	25,000	6,850	3,750	10,300
21,050	10,250	37,450	45,050	21,850	6,050	2,350	8,600
19,000	10,650	35,800	39,650	18,450	5,550	1,450	8,900
16,050	10,650	32,800	35,100	15,550	5,100	3,750	13,700
13,750	11,000	30.050	33,000	13,450	4,400	3,700	12,800
12,400	17.600	28.250	29,550	13.350	4,550	3,150	13,450
11,950	28.550	33,500	26,900	13.300	4,800	2,750	17,200
17,000	29.450	41,900	28,650	13,850	4,700	2,900	22,800
18,350	24,800	46,250	31,600	14,900	4,300	2,100	24,050
17,600	21,250	43,100	29,900	13,750	3,650	550	24,650
15,250	18,700	39,050	28,050	12,050	3,700	2,800	32,100
13,050	16,850	36,650	26,300	10,650	2,600	2,800	28,300
10,100	14,700	27,600	24,650	9,350	1,550	3,100	22,400
9,800	14,000	23,600	31,450	7,250	3,700	3,500	17,900
9,250	18,300	21,250	36,050	6,900	3,650	3,550	14,950
8,600	30.350	20,350	36,550	7,150	3,600	4,550	12,350
9,200	27,950	20,250	33.700	6,750	3,500	7,900	10,400
9,800	22,300	21,700	30,100	6,550	3,650	13,850	9,050
16,600	21,700	23,150	25,700	6,400	3,850	13,550	8,200
31,550	24,150	24,500	26,250	7,350	6,000	12,400	7,100
35,000	22,850	27,350	37,950	8,900	6,200	13,650	6,900
....	19.450	28.200	36.750	8,700	5.200	18.450	7,950
....	16,400	26,850	30,050	8,350	5,050	17,800	7,900
....	15,600	....	24,600	....	4,350	17,300	....

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years endin Sept. 30, 1880–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1890–91.												
1	7,250	15,150	7,250	6,050	15,900	35,450	35,100	21,650	9,950	3,400	9,350	5,6
2	7,000	14,300	6,500	6,850	18,350	28,800	32,750	20,400	10,150	3,650	6,650	5,0
3	6,250	14,650	4,750	6,100	18,100	24,350	32,550	18,600	10,400	3,600	6,150	5,1
4	4,450	14,400	4,350	6,450	15,800	20,400	30,750	18,700	11,800	3,300	5,350	5,2
5	3,850	13,400	5,250	7,300	15,550	18,250	27,600	19,550	11,900	2,900	5,050	4,1
6	7,250	12,550	5,350	7,500	14,450	17,350	25,400	19,000	10,750	3,650	5,300	4,0
7	7,300	12,200	5,900	7,700	13,350	16,650	23,100	17,850	9,900	3,500	5,150	4,8
8	8,350	11,350	6,600	7,500	12,500	15,150	21,250	16,450	9,750	5,450	4,650	5,5
9	9,800	11,050	7,150	7,400	11,900	15,800	20,250	14,400	8,900	6,550	4,200	5,2
10	10,600	11,600	7,100	6,900	11,350	22,250	20,650	12,900	7,850	6,650	4,500	4,8
11	9,900	12,850	7,200	7,100	11,900	26,550	22,500	12,750	6,800	5,700	4,000	4,3
12	9,650	13,200	6,750	9,400	11,500	25,700	36,550	13,000	6,400	5,750	4,150	3,4
13	9,850	13,200	5,950	14,250	10,900	27,850	51,700	13,700	6,100	5,100	4,100	3,2
14	9,750	12,750	6,150	19,150	9,500	37,450	55,250	14,250	5,000	4,400	4,100	4,1
15	9,600	11,400	6,350	19,700	8,850	37,700	61,050	13,700	5,100	4,250	3,050	4,3
16	10,300	10,650	6,250	17,300	9,150	34,900	67,300	12,650	5,050	4,000	1,600	4,2
17	13,900	10,900	6,250	14,500	10,850	29,050	66,100	14,000	4,550	4,200	4,450	4,1
18	33,650	16,850	6,300	12,650	16,450	24,000	61,500	19,600	5,000	3,950	5,400	4,0
19	33,900	26,950	5,800	12,500	20,100	22,050	63,850	21,050	5,650	4,300	5,100	3,2
20	44,000	26,400	5,100	11,900	18,500	20,400	65,650	20,050	7,200	6,500	4,500	1,4
21	43,700	23,300	5,600	11,300	15,450	17,600	59,400	18,300	6,650	6,500	4,050	4,1
22	35,550	18,900	5,050	12,900	14,700	17,350	53,650	15,850	6,950	6,250	4,400	3,6
23	28,000	16,950	5,950	26,700	14,450	29,950	51,950	13,800	8,800	5,200	4,500	2,9
24	29,050	14,800	5,850	31,400	13,750	29,100	50,700	12,350	8,700	4,650	4,600	2,9
25	41,350	12,950	4,550	29,800	17,350	63,250	45,400	12,600	7,600	5,150	5,000	4,1
26	33,700	12,100	5,200	26,600	34,850	60,450	39,600	11,750	6,400	5,600	5,100	2,8
27	25,800	11,650	4,100	22,650	44,950	51,050	36,450	10,600	5,600	5,350	4,950	1,2
28	21,350	10,400	4,700	19,850	44,450	43,000	31,800	9,900	4,700	6,000	10,350	2,9
29	18,350	7,900	5,300	17,750	....	38,400	27,150	9,800	4,600	7,200	10,950	2,9
30	17,150	7,750	5,350	16,600	....	39,500	23,400	10,050	4,050	6,800	7,300	3,0
31	17,200	....	5,950	16,700	....	38,500	....	9,800	....	9,600	6,400	.....
1891–92.												
1	2,900	1,300	5,250	22,800	9,100	7,500	13,600	11,500	22,550	28,450	5,100	11,0
2	2,950	3,550	5,350	18,800	8,750	6,200	16,150	12,150	19,600	25,150	5,250	8,7
3	2,850	3,550	6,000	27,950	8,300	5,950	25,450	12,750	16,850	22,400	6,050	6,4
4	900	2,900	5,450	38,400	8,150	6,450	48,350	14,900	14,700	23,500	5,550	5,0
5	2,900	2,900	8,650	28,200	7,800	6,350	53,500	17,550	13,550	28,800	5,100	4,6
6	2,950	3,550	12,350	20,250	7,350	6,050	51,450	17,600	13,750	29,600	3,900	5,4
7	2,300	3,350	12,400	14,850	6,450	6,550	52,000	16,600	14,400	26,900	2,350	5,1
8	2,400	1,050	12,500	12,350	6,650	7,050	47,150	15,550	15,100	22,700	4,400	4,5
9	2,900	2,950	10,950	10,100	6,850	8,150	39,300	14,450	14,350	17,750	4,250	4,7
10	3,000	2,950	9,400	9,800	6,750	8,850	34,800	12,950	13,850	14,700	4,250	3,6
11	1,700	2,900	8,150	12,600	6,500	11,700	31,350	11,500	12,050	13,950	4,200	2,6
12	3,600	2,950	7,350	9,150	6,250	11,000	25,850	11,300	10,100	12,800	5,000	4,2
13	3,050	3,950	6,300	11,350	5,250	11,800	20,800	13,750	9,650	11,600	9,050	4,2
14	2,950	4,150	6,200	27,500	5,650	10,700	17,400	17,400	8,600	10,150	11,350	4,5
15	2,950	3,850	6,050	63,100	6,150	8,950	15,250	18,700	8,050	9,050	12,950	7,0
16	3,400	4,650	5,750	48,000	6,150	8,250	13,250	21,000	7,000	8,350	12,400	6,4
17	3,350	4,700	4,500	30,100	6,100	7,550	12,750	19,550	6,650	7,250	12,000	5,1
18	1,100	6,050	5,450	23,450	5,900	6,200	12,400	16,950	6,050	7,150	10,500	4,1
19	2,950	7,600	4,600	23,750	5,850	5,700	11,750	14,550	6,950	7,050	8,600	4,6
20	2,900	6,750	4,950	23,950	4,900	5,750	11,200	13,950	7,850	6,600	7,550	4,4
21	2,950	6,050	6,000	17,600	5,550	5,550	10,650	16,950	7,950	6,150	6,700	4,4
22	4,650	5,650	6,000	14,000	6,350	5,600	11,050	31,750	9,450	5,550	6,750	4,3
23	4,600	5,900	7,250	12,600	6,300	6,400	11,550	42,950	13,450	5,050	6,600	4,3
24	3,800	8,800	16,650	12,300	7,100	8,000	11,900	48,300	17,050	4,450	6,050	3,2
25	3,250	10,750	22,800	12,750	7,400	9,100	13,450	42,200	17,150	4,700	5,800	1,8
26	4,300	9,400	20,150	10,450	7,950	9,050	14,850	34,850	16,100	4,300	9,100	4,4
27	3,250	9,150	23,550	11,350	7,950	10,350	14,200	30,100	18,200	4,200	17,700	4,4
28	3,150	8,250	22,300	10,100	7,450	12,300	12,850	29,150	22,400	4,200	21,500	4,4
29	3,550	7,650	18,300	9,100	8,100	13,700	11,750	27,350	31,700	4,200	23,100	4,9
30	3,600	6,850	26,450	9,200	....	13,400	11,600	25,400	33,150	2,750	19,050	5,7
31	3,100	....	33,250	9,000	....	13,050	....	23,950	....	4,000	14,550	.....

icut River at Holyoke, Mass., for the years ending
—1899—Continued.

	eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	3,950	4,700	13,800	33,250	11,250	5,050	3,850	12,800
	3,000	4,900	18,400	40,700	10,350	4,600	4,150	9,150
	3,000	4,700	23,450	42,350	9,100	4,150	3,900	7,650
	2,850	3,800	22,450	67,850	7.800	4,000	3,900	5,950
	2,100	5,150	27,850	94,350	8,700	4,250	2,550	4,350
	3,550	4,300	31,650	80,550	9,100	4,250	2,400	5,300
	3,450	4,350	28,350	63,200	8,950	4,000	3,750	4,200
	3,700	2,650	22,150	51,150	9,700	2,600	3,700	3,250
	4,950	4,800	27,000	42,800	9,250	2,550	3,850	4,900
	6,850	6,250	38,100	38,200	8,500	4,200	4,000	5,850
	2,450	9,500	36,950	35,550	7,850	3,900	3,750	5,250
	4,750	11,800	36,950	34,350	7,600	3,800	3,600	4,800
	2,700	17,050	41,000	38,200	7,250	3,800	3,600	4,400
	9.750	20,950	46,800	34,200	9,950	3,750	2,800	3,950
	8,450	26,450	52,000	36,250	11,850	2,600	2,700	3,750
	8,400	25,650	48,450	34,350	11,250	750	3,200	3,650
	8,400	21,050	39,550	42,550	9,100	3,850	3,250	5,500
	7,350	17,300	32,700	44,600	7,950	3,950	2,750	6,100
	6,450	13,900	28,450	37,700	7,300	2,900	1,700	5,400
	6,450	12,350	26,850	32,000	6,450	1,650	2,950	7,000
	5,900	11,150	26,200	27.050	5,950	2,600	4,800	8,100
	5,900	10,950	28,400	24,550	5,750	3,200	4,600	7,650
	5,900	10,000	30,700	21,500	7,200	1,150	4.750	6,050
	5,450	9,400	30,750	19,300	7,800	3,400	4,850	6,050
	5,200	10,300	29,750	18,700	6,950	3,250	10,200	5,650
	5,300	14,650	29,500	17,400	6,700	3,250	8,800	4,700
	4,900	16,900	28,650	15,250	6,900	3,400	6,750	5,200
	4,650	17,150	27,550	14,150	6,500	3,350	9,050	4,950
	....	15,750	28,200	14,000	5,950	3,350	12,950	4,550
	....	14,750	28,550	13,000	5,800	2,450	17,700	4,400
	....	13,800	....	12,000	....	4,400	17,800	....
	6,100	5,200	11,800	18,450	16,750	6,300	2,850	1,900
	5,750	5,000	14,150	16,800	15,200	5,450	2,650	450
	4,550	5,350	15,150	15,150	14,750	5,500	2,600	1,600
	4,250	5,450	15,200	14,350	15,750	5,150	1,800	1,600
	5,350	7,400	15,750	13,950	15,100	4,300	450	1,600
0	4,750	9,050	15,700	12,450	13,550	3,900	2,750	1,600
0	4,450	16,900	14,450	13,100	12,250	4,050	2,950	1,600
0	4,600	26,600	13,550	13,000	11,050	3,700	3,450	1,600
0	4,650	32,050	14,400	12,800	9,800	4,800	3,950	150
0	3,600	31,250	14,250	11,800	8,600	4,700	3,800	2,350
0	2,950	28,800	14,100	10,750	8,800	4,800	2,600	2,350
0	4,650	33,300	13,650	9,450	8,100	4,450	600	2,350
0	4,500	35,250	13,800	8,300	7,250	4,150	3,700	2,350
0	4,500	33,600	13,350	8,950	6,500	3,100	3,000	2,350
0	4,600	29,850	13,450	8,200	6,250	2,950	2,850	2,350
0	4,600	26,500	15,050	7,600	5,250	3,900	2,750	1,300
0	3,350	22,000	16,050	6,550	1,800	3,900	2,750	4,450
0	2,900	18,900	17,450	6,350	4,600	4,050	2,250	4,000
00	4,950	19,950	18,550	6,300	4,750	4,100	450	3,400
50	5,050	31,750	21,300	6,650	5,650	4,050	2,300	3,950
50	5,800	35,950	25,150	8,200	9,250	2,400	2,300	5,005
50	5,450	33,400	32,200	8,450	9,400	1,450	2,300	4,450
50	5,150	33,550	39,100	7,800	8,800	4,300	2,300	4,150
50	4,400	32,750	42,050	7,700	7,150	4,250	2,300	4,850
50	3,650	26,650	43,300	8,100	6,850	3,550	2,300	4,700
00	4,800	20,200	40,550	11,350	5,700	3,350	450	4,350
50	5,100	21,200	34,950	11,450	5,600	3.350	1,900	2,950
50	5,450	17,800	27,800	11,950	5,100	2,650	1,900	3,050
00	....	16,050	22,600	11,750	4,750	450	1,900	3,400
00	....	14,600	20,350	13,000	6,700	3,100	1,900	650
00	....	13,500	....	16,850	....	3,050	1,900	....

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years endin Sept. 30, 1880–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1894–95.												
1	2,450	5,000	3,350	3,050	3,900	3,150	9,400	21,100	9,800	4,000	2,700	2,7
2	2,450	6,900	1,650	4,100	3,700	2,550	8,450	19,900	8,800	3,800	3,700	3,0
3	2,450	6,550	5,000	4.300	1,650	1,700	8,950	18,850	9,050	3,800	3,150	4,2
4	2,450	9,000	4,900	4,300	4,550	4,100	9,450	16,200	8,200	3,500	1,350	4,5
5	2,450	11,500	4,800	2,800	3,900	3,700	9,850	14,700	8,800	3,300	3,550	3,1
6	2,450	13,300	4,850	2,650	3,650	4,200	10,150	15,500	9,600	3,300	3,250	2,9
7	600	12,500	4,700	4,400	3,250	4,800	10,550	15,000	9,400	3,000	3,350	3,5
8	3,000	10,650	3,600	4,350	3,100	4,750	13,550	14,200	8,400	3,600	3,600	35
9	3,000	9,100	3,300	4,500	2,800	6,300	38,200	13,500	8,150	3,300	4,100	2,8
10	3,050	7,800	5,100	4,700	1,300	7,450	82,950	12,750	8,850	3,900	2,950	2,8
11	6,050	6,800	4,800	5.250	3,150	6,000	89,150	11,750	7,750	3,900	1,900	2,8
12	8,000	7,850	4,950	5,600	3,050	5,200	69,650	11,500	7,600	3,700	4,600	2,8
13	6,950	6,850	8,250	5,900	2,950	5,100	50,800	12,900	5,850	3,050	3,550	2,8
14	6,450	6,750	11,950	7,100	3,050	5,950	63,700	13,350	5,400	550	3,100	2,8
15	8,050	6,600	12,150	6,000	3,150	7,850	98,850	16,300	4,400	3,950	2,950	65
16	7,450	6,850	10,600	6,200	3,600	7,850	115,000	16,800	4,450	4,200	3,500	4,2
17	6,850	5,700	11,350	6,250	950	7,800	109,000	15,250	5,150	3,000	3,500	3,2
18	5,950	6,650	11,400	5,800	3,050	7,250	88,750	12,650	4,550	2,900	1,500	3,0
19	5,650	9,000	10,150	4,700	3,000	6,050	71,250	10,700	4,700	2,850	4,550	3,0
20	5,100	8,200	8,550	4,350	2,950	5,900	58,900	10,900	4,750	2,950	4,050	3,0
21	4,450	7,150	7,550	5,700	3,050	6,050	48,900	9,750	4,750	350	3,400	3,4
22	5,800	6,550	7,200	4,950	3,100	6,300	44,350	8,950	3,100	3,000	3,250	45
23	5,450	6,500	5,400	4,850	3,500	5,550	40,750	7,800	1,050	3,150	3,850	2,70
24	5,000	5,250	4,950	5,050	750	6,350	37,600	7,750	4,250	3,200	3,600	2,70
25	4,800	6,150	3,850	4,850	3,150	7,600	34,900	6,400	3,550	2,950	1,050	2,70
26	4,750	7,650	5,050	3,850	3,150	7,850	32,600	6,200	3,500	2,900	4,050	2,70
27	3,450	7,050	4,250	3,350	3,150	9,000	29,300	8,550	4,500	2,600	3,350	2,70
28	3,700	6,500	4,000	5,150	3,100	10,150	26,050	6,050	5,150	400	3,300	2,70
29	5,050	4,700	3,100	4,900	....	10,250	25,200	7,800	5,550	2,900	3,000	45
30	4,800	4,800	2,600	4,050	....	9,100	22,500	9,050	4,200	2,950	4,350	2,95
31	4,800	....	4,550	3,900	....	8,100	....	10,600	....	2,950	3,600	....
1895–96.												
1	2,950	4,000	27,100	47,350	5,500	66,950	34,400	18,300	6,550	3,900	2,300	2,70
2	3,000	5,550	22,500	39,050	4,850	112,050	36,100	16,050	6,350	3,800	2,450	2,85
3	3,150	5,900	24,900	29,700	5,350	103,450	32,300	14,700	6,450	2,350	3,900	2,70
4	4,350	7,050	26,100	23,850	4,850	65,050	24,650	15,000	6,200	750	3,700	2,70
5	3,400	6,300	21,900	12,200	4,800	37,900	19,600	14,350	5,800	1,700	3,750	2,10
6	2,700	6,250	17,500	9,300	5,550	25,100	18,550	13,900	4,650	2,050	3,650	70
7	4,750	6,150	12,050	7,750	17,150	22,050	18,350	13,700	3,850	2,900	3,800	6,15
8	4,750	6,200	10,800	7,300	20,750	19,050	17,550	13,550	5,100	3,450	2,850	7,75
9	3,150	5,650	10,800	7,600	19,700	17,950	17,700	11,900	4,900	4,450	4,100	8,05
10	3,000	6,200	9,450	7,850	17,700	16,900	19,900	11,000	7,100	6,050	4,650	7,20
11	3,350	15,150	8,800	7,100	14,300	14,050	22,700	11,050	8,850	4,500	4,000	6,45
12	2,800	16,100	7,650	7,250	11,650	10,900	26,950	10,700	8,750	4,300	3,750	4,80
13	1,700	15,000	7,500	8,250	10,600	9,350	37,300	10,700	7,750	4,150	3,750	3,90
14	9,550	22,600	7,050	8,250	9,600	9,300	59,350	11,000	6,450	4,100	3,800	4,40
15	9,250	21,300	7,050	7,700	8,750	8,900	71,100	11,000	6,600	4,000	2,050	4,10
16	7,550	24,700	7,850	7,900	7,600	8,550	77,500	9,050	5,950	4,150	1,300	3,80
17	6,200	23,350	7,450	7,700	7,800	8,950	84,450	7,800	5,700	4,100	2,800	3,65
18	5,200	22,000	7,000	5,800	6,400	10,350	89,200	7,650	5,050	2,650	2,800	3,45
19	3,150	19,850	7,200	6,450	6,250	10,750	88,600	7,700	5,050	450	2,800	2,35
20	3,100	18,550	7,250	7,400	6,600	25,250	81,200	7,350	4,250	4,200	2,800	4,65
21	4,950	17,550	7,750	7,100	6,400	29,250	71,050	7,150	3,500	3,900	2,800	6,20
22	4,850	17,800	10,850	7,100	5,550	25,150	61,950	6,900	4,300	3,400	2,800	6,85
23	3,500	17,050	18,250	6,950	5,150	22,300	54,600	5,900	4,400	3,700	550	8,45
24	3,500	16,950	23,800	6,900	6,550	18,400	46,450	5,650	4,450	4,300	3,300	8,10
25	4,600	22,450	20,950	6,200	6,800	15,300	38,300	6,050	4,300	4,150	3,350	6,85
26	3,600	23,600	21,750	6,000	6,500	15,050	30,800	5,800	4,350	4,100	3,300	4,55
27	400	33,550	22,300	6,800	6,300	19,750	26,750	5,850	2,550	4,550	2,950	4,25
28	4,300	36,450	28,500	6,350	6,100	23,250	23,150	4,850	3,300	4,450	2,700	4,50
29	3,500	37,150	25,050	6,100	9,600	22,250	20,900	5,350	4,050	4,300	1,900	4,45
30	3,450	32,450	21,200	6,100	....	24,050	19,500	5,150	4,150	4,350	450	4,40
31	3,350	....	31,600	6,000	....	26,150	....	5,100	....	4,000	2,800	....

t River at Holyoke, Mass., for the years ending
899—Continued.

.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
00	4,400	21,900	32,950	22,900	10,200	22,350	6,200
00	3,550	22,950	27,800	19,300	9,550	18,950	6,150
00	3,500	25,150	28,000	16,750	9,900	16,050	5,300
50	4,450	24,600	27,100	16,100	9,550	13,950	4,550
00	5,700	27,050	27,500	18,100	8,100	12,800	4,600
50	7,550	37,100	26,350	19,600	7,650	12,750	4,800
50	11,750	46,250	23,900	20,350	7,950	10,550	4,650
00	12,150	44,900	20,550	19,050	9,950	8,750	4,500
00	10,550	42,150	17,050	20,200	13,200	8,950	4,450
250	10,250	45,150	16,150	60,600	11,950	8,400	4,450
150	12,550	36,250	14,500	75,350	9,350	9,150	3,650
400	15,700	31,350	15,400	56,950	8,550	13,650	2,550
500	15,300	26,600	17,500	41,300	13,050	12,600	5,050
250	13,050	25,550	35,800	35,300	37,000	10,200	3,900
150	12,250	28,700	44,050	30,000	57,250	8,150	3,450
100	10,300	41,300	36,550	24,500	58,350	9,600	3,450
200	9,150	48,550	30,000	21,050	50,200	9,150	4,000
250	8,200	50,950	24,900	17,800	39,350	11,050	3,700
950	8,100	49,350	19,700	15,250	31,350	12,300	2,250
950	15,650	44,500	16,850	12,300	23,250	11,800	3,700
600	23,750	39,700	14,600	13,300	18,750	9,750	3,550
950	23,750	34,500	13,600	13,800	17,550	9,050	3,550
900	25,850	30,250	12,450	12,750	19,350	8,650	3,950
800	34,650	27,300	13,400	11,250	21,400	8,750	4,650
850	33,350	29,050	14,050	10,000	20,550	9,400	4,450
,850	25,850	34,650	16,250	8,300	21,100	9,700	4,050
,700	18,600	37,350	18,950	7,900	27,300	9,500	5,150
,700	16,750	37,250	20,350	9,950	24,800	7,850	4,950
....	16,350	36,950	23,050	9,700	44,150	7,050	4,900
....	16,250	37,050	24,600	9,900	53,650	7,250	4,850
....	19,350	....	24,350	....	32,900	6,450	....
,000	8,100	43,500	23,800	14,300	6,000	4,750	5,000
,600	8,400	37,300	22,150	12,950	6,050	3,800	4,650
,050	8,050	29,550	20,450	11,550	5,600	3,450	3,600
,350	8,050	25,850	20,550	10,250	4,800	3,650	3,550
,900	7,500	22,450	22,100	8,650	4,550	4,700	4,000
,350	6,950	20,450	22,650	9,200	4,250	4,350	5,500
7,500	7,800	19,400	20,850	9,000	3,300	4,800	6,850
7,350	8,000	18,400	17,950	8,800	3,450	6,250	6,550
7,350	8,550	16,950	17,300	8,000	3,850	6,150	5,950
7,650	9,650	16,050	15,600	8,050	2,850	5,750	5,050
7,850	11,750	18,650	14,400	7,600	4,400	5,450	3,550
8,100	16,950	20,000	14,400	8,300	4,250	4,800	5,050
9,250	30,700	21,950	18,250	10,500	3,850	4,000	4,850
2,250	66,500	23,950	22,000	15,000	3,450	3,150	3,500
2,450	74,900	26,300	22,450	17,900	3,600	4,750	3,900
1,750	64,700	35,750	23,850	17,000	3,200	3,800	4,700
0,400	53,500	37,000	22,500	15,850	600	3,500	3,550
9,900	50,750	34,200	19,200	13,800	4,050	3,450	650
9,350	55,850	31,500	16,550	12,200	3,350	4,600	4,200
8,750	59,750	28,500	15,150	14,800	3,500	3,950	3,550
9,850	76,150	27,350	14,500	14,350	3,250	4,550	3,400
9,350	68,600	25,400	12,350	13,800	3,200	5,350	3,300
9,250	52,100	23,300	12,450	12,800	3,200	4,850	3,200
9,200	49,050	28,450	13,050	11,750	2,250	4,750	3,000
9,000	44,250	46,850	14,550	10,500	4,100	6,700	6,950
8,800	37,900	50,450	23,300	9,050	4,350	7,550	12,000
7,650	35,450	46,700	23,600	9,750	4,450	5,850	12,550
8,600	38,500	39,200	26,800	9,100	4,600	4,950	12,050
....	41,550	33,500	22,350	8,500	4,500	6,950	10,050
....	43,900	28,450	19,450	7,550	3,400	6,950	8,000
....	46,100	....	16,900	....	1,500	6,150	....

Daily discharge, in second-feet, of Connecticut River at Holyoke, Mass., for the years en Sept. 30, 1880–1899—**Continued.**

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1898–99.											
1	6,300	16,250	12,050	6,500	5,300	11,400	15,650	58,850	7,850	3,050	5,050
2	4,650	14,050	12,600	7,750	5,050	11,400	14,300	59,500	7,800	2,100	4,400
3	5,600	12,700	11,500	8,000	6,200	10,750	15,200	57,850	6,050	3,200	3,700
4	5,050	11,550	11,100	8,550	4,600	9,550	15,350	52,100	5,750	2,500	3,850
5	6,600	10,700	14,150	9,950	5,000	9,700	15,450	45,900	6,250	3,900	2,700
6	23,000	8,950	15,250	13,400	5,250	13,900	15,850	38,550	5,400	3,350	700
7	15,500	10,350	14,800	13,850	5,200	16,150	17,700	31,700	5,450	3,700	3,550
8	12,550	9,850	13,050	11,900	5,000	16,500	23,200	26,750	5,400	3,400	3,550
9	12,200	9,700	11,550	12,000	5,100	15,200	26,200	22,600	5,250	1,900	3,200
10	11,650	10,850	12,250	10,750	5,000	13,650	33,400	19,950	4,000	6,950	3,150
11	9,550	28,750	9,900	9,350	4,500	12,050	35,200	17,900	4,750	6,250	3,100
12	8,600	29,150	9,400	8,150	5,350	11,950	35,850	16,600	5,350	6,850	2,850
13	7,800	21,350	5,800	10,450	5,250	18,650	35,000	15,400	5,300	5,850	800
14	7,200	18,800	5,850	6,050	4,050	22,150	45,250	13,800	4,100	5,150	2,700
15	7,200	16,600	6,150	7,100	3,950	22,400	61,500	14,500	4,500	4,000	2,700
16	9,800	14,950	6,400	9,700	4,300	19,500	73,050	13,400	4,750	3,250	2,700
17	11,550	13,700	6,050	11,750	5,150	17,700	67,250	12,800	3,650	5,150	2,700
18	10,400	13,500	6,600	11,850	4,400	15,050	59,800	12,050	4,650	4,400	2,700
19	10,150	16,200	7,250	10,400	4,600	13,500	64,850	11,300	5,100	4,650	2,700
20	11,950	24,550	6,500	9,000	5,350	14,700	73,700	10,150	4,900	4,550	750
21	12,650	26,650	6,500	7,900	5,650	14,000	73,350	10,100	5,100	4,750	2,400
22	13,250	23,750	7,200	6,550	5,700	12,500	69,850	10,900	5,200	3,200	2,400
23	16,000	20,700	8,550	7,250	6,500	11,750	70,500	10,450	4,850	1,200	2,400
24	15,450	18,000	11,550	7,000	7,450	11,000	77,600	10,150	3,050	4,150	2,400
25	13,450	16,450	12,300	7,700	7,650	10,200	79,600	8,850	1,750	4,250	2,400
26	12,050	14,200	12,650	8,050	8,250	8,600	82,500	8,200	4,900	7,700	2,400
27	17,850	12,750	11,000	7,900	9,550	9,800	82,100	7,250	4,600	8,150	750
28	22,400	10,850	9,650	7,100	10,050	9,550	75,150	6,600	3,300	6,750	2,500
29	21,000	8,850	8,450	5,200	......	11,900	67,700	7,200	4,150	5,150	2,500
30	18,700	10,550	7,600	5,950	......	14,650	61,100	6,600	4,800	3,950	2,500
31	18,300	......	7,700	5,150	......	16,950	......	6,100	......	5,150	2,500

Day.	Oct.	Nov.	Dec.
1899.			
1	850	3,550	5,100
2	3,250	5,500	4,050
3	3,250	8,050	650
4	3,250	9,150	5,500
5	3,250	9,650	4,200
6	3,250	10,400	5,850
7	3,250	8,500	7,150
8	850	7,300	6,300
9	2,550	6,200	3,900
10	2,550	5,650	2,450
11	2,550	4,850	5,300
12	2,550	4,400	5,450
13	2,550	5,850	5,200
14	2,550	5,350	11,300
15	550	5,300	15,100
16	2,350	5,200	14,000
17	2,350	5,250	11,850
18	2,350	3,750	8,650
19	2,350	2,100	6,300
20	2,350	5,500	7,500
21	2,350	5,350	
22	550	4,600	
23	2,800	5,400	
24	2,800	5,400	
25	2,800	4,100	
26	2,800	3,350	
27	2,800	5,600	
28	2,800	5,450	
29	450	5,400	
30	3,200	4,650	
31	3,150	......	

Monthly discharge of Connecticut River at Holyoke, Mass., for the years ending Sept. 1880–1899.

[Drainage area, 8,390 miles.]

Month.	Discharge in second-feet.				Run-o (depth inches draina area)
	Maximum.	Minimum.	Mean.	Per square mile.	
1880.					
January	24,700	6,550	9,650	1.15	
February	24,850	7,330	14,800	1.76	
March	40,150	6,850	15,300	1.82	
April	44,100	7,300	20,600	2.46	
May	23,900	5,650	11,500	1.37	
June	8,750	1,750	4,160	.496	
July	8,300	1,950	3,640	.434	
August	4,650	0	2,170	.259	
September	2,350	0	1,700	.203	

Holyoke, Mass., for the years ending Sept. 30,
—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).
mum.	Minimum.	Mean.	Per square mile.	
4,950	0	2,260	0.269	0.31
11,050	2,100	6,100	.727	.81
3,850	1,800	3,050	.364	.42
2,950	0	2,520	.300	.35
13,050	0	5,730	.683	.71
19,500	9,150	13,600	1.62	1.87
48,500	7,750	22,400	2.67	2.98
49,050	12,350	27,000	3.22	3.71
11,450	3,200	6,210	.740	.83
7,600	1,000	3,950	.471	.54
7,050	450	3,900	.465	.54
4,750	0	2,950	.352	.39
49,050	0	8,290	.988	13.46
6,600	0	3,200	.381	.44
18,850	5,900	11,300	1.35	1.51
46,850	4,750	15,800	1.88	2.17
34,000	4,050	8,790	1.05	1.21
22,000	4,400	9,100	1.08	1.12
43,650	8,950	19,500	2.32	2.68
25,800	11,400	18,200	2.17	2.42
38,500	12,700	20,200	2.41	2.78
35,300	5,750	17,600	2.10	2.34
9,250	1,600	5,410	.645	.74
3,650	250	2,800	.334	.39
45,000	250	7,950	.948	1.06
46,850	0	11,700	1.39	18.86
6,800	3,500	4,610	.549	.63
3,850	1,050	3,360	.400	.45
3,700	850	2,740	.327	.38
3,700	400	2,630	.313	.36
5,750	2,150	3,930	.468	.49
8,400	3,150	5,270	.628	.72
68,300	7,550	33,300	3.97	4.43
29,350	12,200	19,600	2.34	2.70
17,200	5,000	10,800	1.29	1.44
8,550	1,750	5,610	.669	.77
4,100	950	3,060	.365	.42
2,500	250	1,880	.224	.25
68,300	250	8,050	.959	13.04
8,350	950	3,540	.422	.49
10,100	2,650	5,070	.604	.67
6,650	1,550	3,910	.466	.54
8,800	4,850	6,210	.740	.85
28,100	5,450	14,300	1.70	1.83
71,900	7,300	22,000	2.62	3.02
70,800	20,400	40,200	4.79	5.34
35,450	17,550	26,300	3.13	3.61
15,500	5,050	8,940	1.07	1.19
6,200	3,000	4,360	.520	.60
5,800	1,000	3,190	.380	.44
5,450	500	2,820	.336	.37
71,900	500	11,700	1.39	18.95
6,100	1,100	4,020	.479	.55
17,650	4,000	8,380	.999	1.11
28,100	4,700	11,200	1.33	1.53
36,650	7,050	15,300	1.82	2.10
9,150	5,250	7,140	.851	.89
6,150	3,600	4,810	.573	.66
63,950	8,500	37,400	4.46	4.98
33,550	7,100	16,500	1.97	2.27
17,600	3,100	7,010	.836	.93
12,050	2,950	7,050	.840	.97
13,550	2,950	6,150	.733	.85
8,150	3,050	5,580	.665	.74
63,950	1,100	10,900	1.30	17.58

***Monthly discharge of Connecticut River at Holyoke, Mass., for the years ending Sept. 30 1880–1899*—Continued.**

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1885–86.					
October	18,400	3,750	7,980	0.951	1.10
November	47,200	7,500	20,800	2.48	2.77
December	24,600	4,750	11,300	1.35	1.56
January	58,950	7,600	15,900	1.90	2.19
February	37,500	7,200	16,100	1.92	2.00
March	22,750	6,700	9,600	1.14	1.31
April	80,150	16,550	37,300	4.45	4.96
May	19,600	7,500	12,800	1.53	1.76
June	12,900	4,550	7,500	.894	1.00
July	4,350	850	3,050	.364	.42
August	3,950	550	2,710	.323	.37
September	5,100	50	2,490	.297	.33
The year	80,150	50	12,200	1.45	19.77
1886–87.					
October	8,850	1,000	4,370	.521	.60
November	34,800	5,850	14,700	1.75	1.95
December	21,050	6,150	10,400	1.24	1.43
January	39,150	6,650	11,800	1.41	1.63
February	31,900	7,800	13,700	1.63	1.70
March	9,900	7,200	8,160	.973	1.12
April	85,500	8,100	44,300	5.28	5.89
May	72,500	10,050	31,100	3.71	4.28
June	27,650	5,150	12,700	1.51	1.68
July	32,300	5,550	11,000	1.31	1.51
August	26,750	5,650	12,000	1.43	1.65
September	8,500	3,650	5,520	.658	.73
The year	85,500	1,000	14,900	1.78	24.17
1887–88.					
October	6,200	3,300	4,480	.534	.62
November	18,700	3,500	6,770	.807	.90
December	27,600	6,100	11,900	1.42	1.64
January	13,750	6,850	8,830	1.05	1.21
February	14,100	6,600	8,550	1.02	1.10
March	32,400	5,650	12,000	1.43	1.65
April	90,900	27,150	38,900	4.64	5.18
May	99,750	16,700	47,800	5.70	6.57
June	17,600	6,300	10,500	1.25	1.40
July	7,600	1,600	4,310	.514	.59
August	8,150	1,100	4,690	.559	.64
September	42,000	4,900	13,000	1.55	1.73
The year	99,750	1,100	14,300	1.70	23.23
1888–89.					
October	23,050	13,600	18,000	2.15	2.48
November	38,050	10,950	22,600	2.69	3.00
December	59,300	5,700	19,600	2.34	2.70
January	31,000	9,200	16,700	1.99	2.29
February	11,100	5,600	7,290	.869	.90
March	24,600	5,750	13,600	1.62	1.87
April	37,800	15,750	26,500	3.16	3.53
May	29,050	8,500	13,800	1.64	1.89
June	21,750	6,300	13,100	1.56	1.74
July	18,500	5,750	9,120	1.09	1.26
August	21,050	2,700	9,240	1.10	1.27
September	17,450	1,350	6,060	.722	.81
The year	59,300	1,350	14,700	1.75	23.74
1889–90.					
October	22,350	4,900	11,500	1.37	1.58
November	37,250	12,050	19,000	2.26	2.52
December	37,650	9,350	20,500	2.44	2.81
January	23,200	9,100	15,000	1.79	2.06
February	35,000	8,550	14,800	1.76	1.83
March	37,250	9,650	19,700	2.35	2.71
April	46,250	13,600	29,400	3.50	3.90
May	46,750	23,800	31,300	3.73	4.30
June	25,950	6,400	13,200	1.57	1.75
July	7,450	1,550	4,900	.584	.67
August	18,450	550	6,020	.718	.83
September	32,100	6,900	14,400	1.72	1.92
The year	46,750	550	16,600	1.98	26.88

Holyoke, Mass., for the years ending Sept. 30, —Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).
imum.	Minimum.	Mean.	Per square mile.	
44,000	3,850	18,300	2.18	2.51
26,950	7,750	14,100	1.68	1.87
7,250	4,100	5,830	.695	.80
31,400	6,050	14,200	1.69	1.95
44,950	8,850	17,000	2.03	2.11
63,250	15,150	29,900	3.56	4.10
67,300	20,250	41,300	4.92	5.49
21,650	9,800	15,100	1.80	2.08
11,900	4,050	7,410	.883	.99
9,600	2,900	5,130	.611	.70
10,950	1,600	5,300	.632	.73
5,600	1,200	3,890	.464	.52
67,300	1,200	14,800	1.76	23.85
4,650	900	3,040	.362	.42
10,750	1,050	5,140	.613	.68
33,250	4,500	11,300	1.35	1.56
63,100	9,000	19,500	2.32	2.68
9,100	4,900	6,860	.818	.88
13,700	5,550	8,490	1.01	1.16
53,500	10,650	22,600	2.69	3.00
48,300	11,300	21,200	2.53	2.92
33,150	6,050	14,300	1.70	1.90
29,600	2,750	12,400	1.48	1.71
23,100	2,350	8,930	1.06	1.22
11,060	1,800	4,960	.591	.66
63,100	900	11,600	1.38	18.79
6,250	3,450	4,860	.579	.67
40,400	5,900	15,800	1.88	2.10
10,450	2,550	6,660	.794	.92
6,850	950	3,560	.424	.49
14,750	2,100	6,240	.744	.77
26,450	2,650	11,800	1.41	1.63
52,000	13,800	31,000	3.69	4.12
94,350	12,000	36,200	4.31	4.97
11,850	5,750	8,160	.973	1.09
5,050	750	3,370	.402	.46
17,800	1,700	5,440	.648	.75
12,800	3,250	5,680	.677	.76
94,350	750	11,600	1.38	18.73
11,800	2,900	5,300	.632	.73
9,900	2,900	5,220	.622	.69
17,550	3,250	7,500	.894	1.03
8,750	4,050	6,250	.745	.86
6,100	2,900	4,640	.553	.58
35,950	5,000	22,300	2.66	3.07
43,300	11,800	21,000	2.50	2.79
18,450	6,300	10,900	1.30	1.50
16,750	1,800	8,700	1.04	1.16
6,300	450	3,850	.459	.53
3,950	450	2,320	.277	.32
5,050	150	2,700	.322	.36
43,300	150	8,400	1.00	13.62
8,050	600	4,610	.549	.63
13,300	4,700	7,530	.897	1.00
12,150	1,650	6,060	.722	.83
7,100	2,650	4,740	.565	.65
4,550	750	2,990	.356	.37
10,250	1,700	6,260	.746	.86
115,000	8,450	45,300	5.40	6.02
21,000	6,050	12,300	1.47	1.70
9,800	1,050	6,110	.728	.81
4,200	350	3,030	.361	.42
4,600	1,050	3,280	.391	.45
4,550	350	2,740	.327	.36
115,000	350	8,720	1.04	14.10

Monthly discharge of Connecticut River at Holyoke, Mass., for the years ending Sept. 30, 1880–1899—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1895–96.					
October	9,550	400	4,100	0.489	0.56
November	37,150	4,000	17,100	2.04	2.28
December	31,600	7,000	15,800	1.88	2.17
January	47,350	5,800	10,900	1.30	1.50
February	20,750	4,800	8,780	1.05	1.13
March	112,050	8,550	27,200	3.24	3.74
April	89,200	17,550	42,400	5.05	5.63
May	18,300	4,850	9,680	1.15	1.33
June	8,850	2,550	5,360	.639	.71
July	6,050	450	3,650	.435	.50
August	4,650	450	2,960	.353	.41
September	8,450	700	4,770	.569	.63
The year	112,050	400	12,700	1.51	20.59
1896–97.					
October	22,100	3,500	11,000	1.31	1.51
November	30,450	7,900	14,100	1.68	1.87
December	17,900	3,400	7,620	.908	1.05
January	10,350	2,300	5,010	.597	.69
February	14,250	2,550	5,780	.689	.72
March	34,650	3,500	14,500	1.73	1.99
April	50,950	21,900	35,500	4.23	4.72
May	44,050	12,450	22,500	2.68	3.09
June	75,350	7,900	22,300	2.66	2.97
July	58.350	7,650	23,500	2.80	3.23
August	22,350	6,450	10,800	1.29	1.49
September	6,200	2,250	4,310	.514	.57
The year	75,350	2,250	14,800	1.76	23.90
1897–98.					
October	5,300	1,300	3,670	.437	.50
November	29,550	3,850	14,900	1.78	1.99
December	70,650	8,950	21,800	2.60	3.00
January	16,050	7,500	10.300	1.23	1.42
February	12,450	6,350	8,670	1.03	1.07
March	76,150	6,950	35,500	4.23	4.88
April	50,450	16,050	29,200	3.48	3.88
May	26,800	12,350	19,100	2.28	2.63
June	17,900	7,550	11,400	1.36	1.52
July	6,050	600	3,800	.453	.52
August	7,550	3,150	4,960	.591	.68
September	12,550	650	5,420	.646	.72
The year	76,150	600	14,100	1.68	22.81
1898–99.					
October	23,000	4,650	12,200	1.45	1.67
November	29,150	8,850	15,800	1.88	2.10
December	15,250	5,800	9,720	1.16	1.34
January	13,850	5,150	8,780	1.05	1.21
February	10,050	3,950	5,690	.678	.71
March	22,400	8,600	13,800	1.64	1.89
April	82,500	14,300	49,400	5.89	6.57
May	59,500	6,100	20,800	2.48	2.86
June	7,850	1,750	4,930	.588	.66
July	8,150	1,200	4,470	.533	.61
August	5,050	700	2,670	.318	.37
September	4,150	400	2,530	.302	.34
They year	82,500	400	12,600	1.50	20.33
1899.					
October	3,250	450	2,560	.305	.35
November	10,400	2,100	5,690	.678	.76
December	15,100	650	6,930	.826	.95

cticut River at Holyoke, Mass., during the years
t. 30, 1881–1899.

ys of deficiency in discharge.

–84	1884–85	1885–86	1886–87	1887–88	1888–89	1889–90	1890–91
4	....	5	....	....	....	1	....
9	1	7	2	1	1	2	2
12	1	8	2	3	1	3	3
12	1	23	4	4	4	5	3
41	4	55	4	7	6	11	9
73	18	80	17	18	12	14	17
07	39	92	27	42	20	31	24
45	73	97	29	65	23	35	50
64	95	105	33	80	25	40	65
84	122	114	37	88	27	45	92
02	147	121	48	102	39	48	107
09	161	124	69	123	46	56	123
215	179	136	84	143	61	63	137
227	191	148	102	174	76	73	151
232	211	162	131	197	86	78	158
240	220	173	151	208	92	82	159
249	228	185	172	219	100	89	163
251	245	191	186	226	111	100	166
254	251	202	207	231	122	109	180
261	262	219	221	243	145	122	194
266	275	240	231	255	170	130	208
278	292	272	257	269	197	166	233
284	299	286	273	277	225	196	253
292	318	310	295	295	288	254	284
310	331	322	315	307	321	297	304
333	340	332	326	316	342	323	322
340	348	340	330	332	358	341	332
350	353	348	337	338	363	358	343
355	359	360	345	347	363	365	350
366	365	364	362	361	365	....	365
....	....	365	365	366	....	....	....

Days of deficiency in discharge.

1893–94	1894–95	1895–96	1896–97	1897–98	1898–99
8	10	6	....	2	7
10	14	7	....	3	9
24	19	10	....	5	11
38	25	17	3	7	30
54	59	37	7	10	47
71	109	55	17	36	65
89	142	76	40	58	75
122	165	108	58	73	90
159	197	126	88	95	104
184	215	135	101	103	133
204	228	149	105	108	141
220	243	176	111	114	151
230	256	188	115	123	163
241	263	205	118	128	174
251	277	223	126	144	185
262	286	228	137	159	192
270	294	235	146	172	199
275	303	241	155	186	202
277	307	244	169	194	215
280	317	253	183	206	233
289	323	259	195	215	252
304	332	264	229	240	280
323	337	273	245	264	301
336	342	299	276	293	321
342	344	325	306	317	332
349	347	337	323	330	337
359	349	343	334	334	339
362	351	350	346	342	343
365	354	352	357	350	345
....	359	359	364	364	360
....	363	364	365	365	365

al horsepower per foot fall that may be developed at different
days on which the discharge and corresponding horsepower
mns for discharge and horsepower. In using this table allow-
he principal ones being the wheel loss, which may be as large
be as large as 5 per cent.

MILLERS RIVER BASIN.

GENERAL FEATURES.

Millers River is formed in the town of Ashburnham by the union of Bear Meadow and Bluefield brooks. Bluefield Brook, which drains the larger area and is therefore considered the continuation of the river, rises in the southwestern part of the town of New Ipswich, Hillsborough County, N. H., in a small pond on the south slope of Barrett Mountain, and flows southwestward 3½ miles to its junction with Bear Meadow Brook. From this point the general course of the Millers is southwesterly and westerly to Millers Falls, where it turns sharply and flows northward to its junction with the Connecticut. The river is about 45 miles long and drains 394 square miles. The principal tributary streams from the north are Priest Brook, Tully River, Orcutt, Moss, and Keyup brooks; from the south, Otter River, Beaver Brook, Mill Creek, and Whetstone, Osgood, and Wickett brooks.

The basin contains a large number of ponds, the largest being Lake Monomonac. Many of these ponds are regulated for the benefit of storage, and for this reason the flow is not flashy, presenting in this respect a striking contrast to Deerfield River, which enters the Connecticut from the west and drains a somewhat larger area. The precipitation in the basin ranges from 45 inches in the upper part to 40 inches in the lower.

Much of the region drained is well wooded, hardwood growths predominating. The principal rock of the region is granite, and clay and sand are abundant.

The water power afforded by the river has been fairly well developed, especially between Athol and Millers Falls, but much of the power now lost in the rapids below Erving might be conserved and the value of the present power units might be materially increased by utilizing more of the available storage sites.

MILLERS RIVER AT WENDELL DEPOT, MASS.

LOCATION.—At the railroad bridge at Wendell Depot, immediately below the dam of the Athol Gas & Electric Co.

DRAINAGE AREA.—353 square miles.

RECORDS AVAILABLE.—Discharge measurements June 5, 1909, to September 22, 1913.

GAGE.—Chain gage at the bridge 1909–1912; in 1913 two gages—one in the pond above the hydroelectric plant and the other in the tailrace.

DISCHARGE MEASUREMENTS.—Made from the railroad bridge or by wading. Measurements for rating wheels made from footbridge across tailrace.

CHANNEL AND CONTROL.—Bed rough; control at high and medium stages, a dam 1½ miles below station.

EXTREMES OF DISCHARGE.—Maximum discharge, approximately 4,500 second-feet, morning of March 28, 1913.

WINTER FLOW.—Discharge relation affected by ice during short periods.

iver is under complete control of the power
o., which was put into operation June, 1910.
Orange and Athol, also affect distribution of

f diurnal fluctuations incident to the opera-
Gas & Electric Co. made it impossible to base
o gage readings a day, and an attempt was
ates and wheel-gate openings and ratings of
power plant. Owing to the range and rapidity
necessity of installing recording instruments
d to be impracticable to secure accurate dis-

the computation of discharge and are there-

er at Wendell Depot, Mass., during 1909–1913.

s- ge.	Date.	Made by—	Gage height.	Dis-charge.
-ft.			*Feet.*	*Sec.-ft.*
598	Feb. 20	F. B. Saunders	1.42	208
463	27	.....do	1.82	332
104	28	.....do	2.15	499
229	Mar. 11	.....do	3.10	936
132	15	.....do	2.90	879
[a] 23	17	.....do	3.00	799
376	28	.....do	5.30	2,750
	29	.....do	4.80	2,480
	30	.....do	5.10	2,630
400	31	.....do	4.92	2,530
,360	Apr. 2	.....do	2.95	1,090
,300	4	.....do	2.48	1,030
,840	4	.....do	2.49	806
[c] 97	6	.....do	3.25	1,130
[c] 131	7	.....do	4.38	2,200
[d] 34	8	.....do	4.55	2,230
	8	.....do	4.23	2,150
204	1912.			
186	Feb. 14	G. H. Canfield	[b] 2.60	438
270	Nov. 22	C. S. De Golyer	1.90	176
124				

Gage height.		Dis-charge.	Wheel gate openings.
ond ge.	Tail-race gage.		
eet.	*Feet.*	*Sec.-ft.*	
99.25	....	[d] 20.0	Gates all closed.
99.75	....	[d] 25.5	Do.
94.32	78.16	147	0.49 opening on two wheels.
95.68	77.89	259	0.49 opening on four wheels.
96.16	77.78	204	0.67 opening on two wheels.
96.08	78.03	275	0.91 opening on two wheels.
95.92	78.36	342	0.65 opening on four wheels.

es of making the two measurements. Results show variable

MILLERS RIVER AT ERVING, MASS.

Location.—At downstream end of chair factory at Erving, about 8 miles above the confluence of Millers River with Connecticut River and below all important tributaries.

Drainage area.—372 square miles.

Records available.—August 1, 1914, to September 30, 1915.

Gages.—Staff gage attached to factory August 1, 1914, to June 30, 1915; water-stage recorder July 1 to September 30, 1915.

Discharge measurements.—Made from cable or by wading.

Channel and control.—Bed composed of coarse gravel and bowlders; control for low stages is a short distance below the gage and is practically permanent.

Extremes of stage.—Maximum stage recorded: 5.5 feet at 4 p. m., February 25, 1915; discharge, 4,850 second-feet. Minimum discharge, practically no flow at various times, water being stored farther upstream.

Winter flow.—Discharge relation somewhat affected by ice.

Regulation.—Operation of power plants at Athol, Orange, Wendell, and Erving affects the flow to such an extent that mean daily discharge can not be accurately determined from two gage heights a day.

Accuracy.—Rating curve fairly well defined, partly by measurements obtained subsequent to September 30, 1915. Monthly records prior to July 1, 1915, obtained as explained in the footnote to the daily discharge table, are somewhat uncertain.

Discharge measurements of Millers River at Erving, Mass., during 1914–15.

Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*
July 24	R. S. Barnes	[a] 1.68	146
28	.....do	[a] 1.80	138
Aug. 21	C. H. Pierce	2.07	226
Sept. 22	R. S. Barnes	1.97	204
Nov. 24	R. S. Barnes	1.88	192
1915.			
Aug. 18	Hardin Thweatt	2.80	643
Sept. 22	.....do	2.33	404

[a] Determined from a reference point.

s River at Erving, Mass., for the years ending
30, 1914–15.

taff gage.]

	Day.	August.		September.	
.		A. M.	P. M.	A. M.	P. M.
	1914—Contd.				
73	17	202	213	216	130
37	18	220	141	205	157
50	19	187	138	202	111
73	20	224	183	a 8	(c)
70	21	232	400	202	180
	22	320	340	209	114
18	23	a 202	(c)	202	116
53	24	340	236	205	170
36	25	248	150	216	187
27	26	205	209	224	130
21	27	232	205	a 5	(c)
37	28	202	153	205	69
	29	220	130	173	39
66	30	a 48	(c)	4	127
90	31	228	325	....	....
94					

r.	November.		February.		March.	
P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
124	a 35	(c)	....	....	1,060	1,230
124	83	35	....	....	1,290	1,160
69	74	209	....	....	1,310	788
(c)	213	46	....	....	1,510	804
127	101	85	....	....	836	644
94	220	54	....	....	788	630
98	205	72	....	....	a 588	(c)
150	a 0	(c)	....	....	932	630
85	89	150	....	....	600	618
141	228	69	....	....	612	612
(c)	236	76	....	....	612	624
30	52	76	....	....	624	570
74	224	58	....	....	576	445
78	157	124	....	....	a 385	(c)
76	a 4	(c)	....	....	558	355
72	144	160	1,540	1,330	415	492
83	220	44	1,360	1,300	360	486
(c)	141	60	1,370	1,090	335	612
153	213	72	1,260	923	468	528
150	150	83	960	812	504	305
157	147	35	a 748	(c)	a 365	(c)
124	a 7	(c)	788	637	540	385
157	150	220	812	780	350	450
133	213	39	869	887	430	445
(c)	220	41	3,010	4,850	320	504
89	33	(c)	4,480	4,100	534	564
127	150	138	3,320	2,820	456	430
41	256	58	a 2,060	(c)	a 435	(c)
31	a 41	(c)	....	....	504	400
68	220	202	....	....	315	335
46	....	....	....	....	425	272

dings made twice a day.
scharge taken as mean of discharge for preceding and
rds.

Daily discharge, in second-feet, of Millers River at Erving, Mass., for the years ending Sept. 30, 1914–15—Continued.

Day.	April.		May.		June.		July.		August.		September.	
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
1915.												
1	708	582	1,510	1,170	474	340	240	284	[a] 450	(c)	400	522
2	305	355	[a] 1,310	(c)	280	121	300	456	651	534	252	420
3	435	456	1,150	1,110	213	370	672	788	665	708	320	405
4	[a] 198	(c)	1,150	1,050	224	138	[a] 820	(c)	564	2,730	280	355
5	492	435	950	896	124	130	732	716	3,210	2,910	[a] 153	(c)
6	370	658	860	828	[a] 48	(c)	570	606	2,640	2,560	256	3
7	335	588	740	748	232	360	546	606	2,390	2,390	106	180
8	630	686	588	686	220	53	390	540	[a] 2,000	(c)	183	462
9	804	732	[a] 618	(c)	224	114	2,730	2,820	1,720	1,360	157	415
10	878	679	672	658	202	96	2,560	2,560	1,370	1,240	420	320
11	[a] 923	(c)	686	606	228	180	[a] 2,080	(c)	1,140	1,130	173	252
12	1,820	2,230	665	686	121	111	1,630	1,410	1,620	828	[a] 173	(c)
13	2,230	2,080	651	658	[a] 52	(c)	1,220	950	923	950	276	268
14	1,860	1,510	492	462	236	350	606	780	980	960	213	345
15	1,420	923	400	410	260	220	748	764	[a] 844	(c)	248	365
16	1,190	1,100	[a] 330	(c)	240	153	658	748	724	740	205	445
17	1,020	780	564	450	228	205	430	658	624	732	252	345
18	[a] 716	(c)	350	430	240	202	[a] 205	(c)	564	724	260	252
19	679	665	462	480	127	183	335	510	355	724	[a] 41	(c)
20	570	708	325	480	[a] 60	(c)	330	492	350	679	232	370
21	612	672	236	370	410	360	256	300	320	325	205	365
22	612	637	187	445	228	325	516	546	[a] 213	(c)	244	330
23	588	594	[a] 209	(c)	224	425	612	672	700	679	288	456
24	570	700	486	430	252	160	582	546	370	644	248	450
25	[a] 300	(c)	276	510	240	213	[a] 335	(c)	390	665	345	176
26	492	510	280	300	144	194	345	340	380	630	[a] 173	(c)
27	606	630	280	335	[a] 53	(c)	498	600	400	576	380	292
28	612	450	368	445	220	325	335	552	380	582	240	202
29	400	450	202	440	236	170	395	606	[a] 240	(c)	248	40
30	570	732	[a] 180	(c)	244	248	564	630	474	296	244	224
31	......	......	180	480	......	......	564	606	310	498	......	......

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1915.				1915.				1915.			
1	284	[a] 468	385	12	1,510	878	[a] 153	23	534	558	232
2	390	445	335	13	1,130	914	264	24	440	498	260
3	665	588	345	14	748	869	232	25	[a] 350	510	127
4	[a] 724	1,120	395	15	788	[a] 748	236	26	325	492	[a] 166
5	693	2,730	[a] 236	16	780	644	252	27	462	516	244
6	510	2,310	141	17	644	665	220	28	440	528	213
7	534	2,150	144	18	[a] 468	582	[b] 190	29	462	[a] 209	98
8	724	[a] 1,670	248	19	486	522	[a] [b] 135	30	522	305	187
9	2,560	1,430	224	20	492	504	[b] 200	31	528	330	......
10	2,310	1,180	355	21	[b] 285	430	190				
11	[a] 1,760	1,000	260	22	450	[a] 340	220				

[a] Sunday.

[b] Discharge estimated by comparison with readings made twice a day.

[c] Gage read in morning only. Afternoon discharge taken as mean of discharge for preceding and following mornings in computing monthly records.

NOTE.—Discharge computed from a rating curve fairly well defined below 1,800 second-feet, several discharge measurements obtained subsequent to Sept. 30, 1915, being used to determine the curve. Mean discharge computed from automatic gage records. A discharge record computed from two readings a day, made about 8 a. m. and 4. p. m. on staff gage, is given for July, August, and September, 1915, subsequent to installation of automatic gage, for the purpose of comparing record obtained from two readings a day with that obtained by means of the automatic gage. Monthly discharge for period prior to installation of automatic gage obtained by applying a reduction factor of 0.90 to means from readings twice a day, this factor being determined by a comparative study of results subsequent to installation of automatic gage. Discharge relation affected by ice at various times during December, 1914, and January and February, 1915; discharge for these months estimated from observer's record and climatic data.

, Mass., for the years ending Sept. 30, 1914–15.

372 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
n.	Minimum.	Mean.	Per square mile.		
....	....	160	0.430	0.50	B.
....	....	125	.336	.37	B.
....	....	119	.320	.37	B.
....	....	103	.277	.31	B.
....	....	82.5	.222	.26	D.
....	....	652	1.75	2.02	C.
....	....	1,010	2.72	2.83	C.
....	....	530	1.42	1.64	B.
....	....	695	1.87	2.09	B.
....	....	518	1.39	1.60	B.
....	....	190	.511	.57	B.
60	284	742	1.99	2.29	A.
30	209	843	2.27	2.62	A.
95	98	230	.618	.69	A.
....	....	471	1.27	17.29	

VENDELL DEPOT, MASS.

illers River, at Wendell Depot.
pproximate).
er 16, 1909; April 25 to August 27, 1910.
to highway bridge 100 feet above mouth of
nd above a weir about one-fourth mile above

wading.
n rough and rocky; one channel at all stages.
rowned out by the Athol Gas & Electric Co.'s
10 was a sharp-crested weir constructed about
eam.
discharge for 24 hours: 70 second-feet, April
4 hours: 0.3 second-foot, June 30, 1910.
roximate.

k at Wendell Depot, Mass., during 1909–10.

r- ge.	Date.	Made by—	Gage height.	Discharge.
ft.	1910.		*Feet.*	*Sec.-ft.*
3	Apr. 25	D. M. Wood............	.55	19.3
6	July 19	H. B. Alvord............	.20	2.8
1.5	Sept. 14	W. G. Hoyt............	.10	1.77
2				
6				
0.5				

age at the meter station at the bridge. The gage heights

Daily discharge, in second-feet, of Moss Brook at Wendell Depot, Mass.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.
1909.						1909.			
1	....	3.1	2.4	2.7	3.6	16	7.4	2.4	4.6
2	....	3.1	2.2	2.7	3.6	17	6.8	3.6	7.4
3	....	3.1	1.8	2.5	3.6	18	15.1	3.3	10.3
4	7.4	3.1	1.8	2.4	3.6	19	15.1	3.1	9.6
5	7.4	3.5	3.3	2.7	3.3	20	9.6	2.7	4.6
6	25.8	3.1	3.1	2.7	3.3	21	9.0	2.7	4.6
7	17.4	3.1	3.1	2.5	3.1	22	7.4	2.4	3.5
8	12.9	3.1	2.9	2.5	4.6	23	5.7	2.4	3.1
9	9.9	2.7	2.7	2.4	4.2	24	5.7	3.1	2.9
10	9.0	2.7	2.4	2.4	3.8	25	3.6	2.7	2.9
11	12.2	2.7	1.8	2.7	3.3	26	3.1	2.7	2.7
12	10.6	2.7	1.8	2.7	3.3	27	3.1	2.7	2.5
13	9.0	2.7	2.7	2.5	3.1	28	4.6	2.7	2.4
14	[illegible].8	2.7	2.5	2.5	3.1	29	4.2	2.7	2.4
15	8.2	2.7	2.4	2.5	2.7	30	3.5	2.4	2.4
						31	....	2.4	2.2

NOTE.—Discharge determined from a poorly defined rating curve. Discharge Aug. 17, 1909,

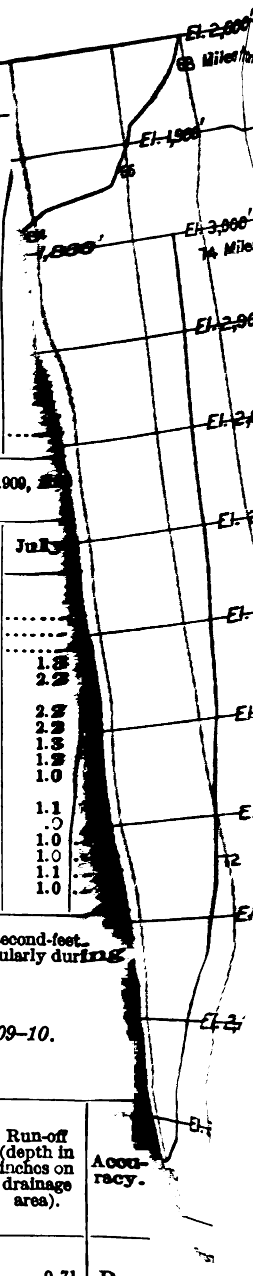
Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.
1910.						1910.				
1	....	26	7.7	....	1.0	16	....	10.2	6.4	....
2	....	23	6.4	....	1.0	17	....	9.5	14.6	....
3	....	20	5.7	....	3.2	18	....	12.2	12.6	....
4	....	28	4.1	....	2.3	19	....	19.6	9.5	1.8
5	....	29	5.5	....	5.3	20	....	13.5	6.4	2.2
6	....	25	6.9	....	2.7	21	....	12.2	4.4	2.2
7	....	19.0	10.4	....	2.2	22	....	12.2	3.2	2.2
8	....	21	7.6	....	1.7	23	....	10.4	2.6	1.3
9	....	17.1	5.7	....	1.2	24	....	9.3	1.7	1.2
10	....	19.0	6.4	....	1.2	25	16.2	7.4	1.3	1.0
11	....	17.1	34	....	3.2	26	43	7.1	.9	1.1
12	....	14.9	27	....	2.4	27	70	6.4	.8	.9
13	....	13.5	19.9	....	1.3	28	45	5.7	1.0	1.0
14	....	12.2	12.4	....	1.4	29	33	4.7	.6	1.0
15	....	11.3	8.1	....	1.5	30	29	3.7	.3	1.1
						31	....	6.4	....	1.0

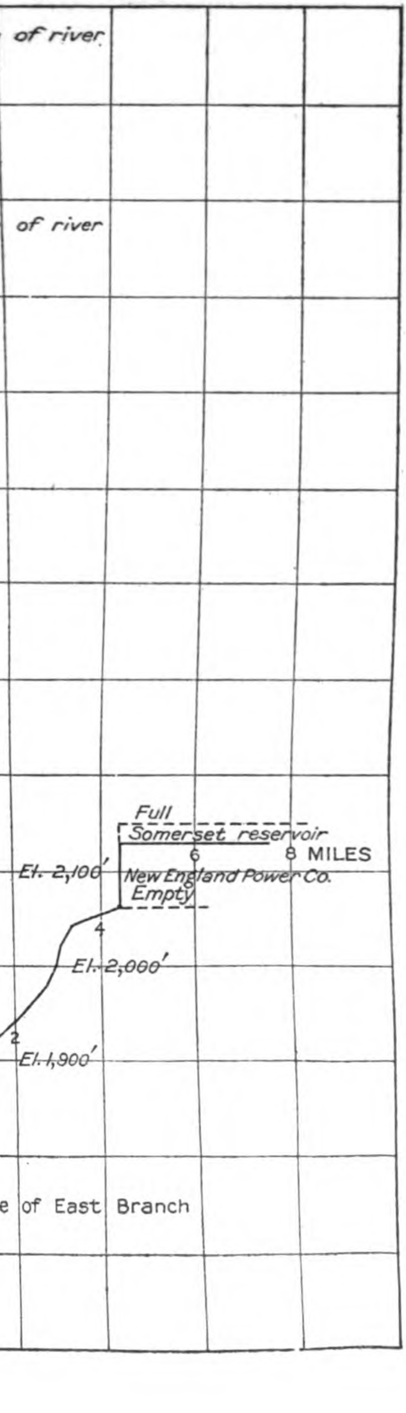
NOTE.—Discharge determined from a rating curve well defined below discharge of 20 second-feet. values, however, are somewhat vitiated by variable leakage underneath the weir, particularly during later part of June.
Discharge interpolated June 5, 12, 19, July 24, Aug. 7, and 14–20.

Monthly discharge of Moss Brook at Wendell Depot, Mass., for 1909–10.

[Drainage area, 12.5 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1909.						
June 4–30	25.8	3.1	8.98	0.718	0.71	D.
July	3.6	2.4	2.84	.227	.26	D.
August	10.3	1.8	3.39	.271	.31	D.
September	24.0	2.4	4.58	.366	.41	D.
October 1–16	4.6	2.7	3.43	.274	.16	D.
1910.						
April 25–30	70	16.2	39.4	3.18	.71	D.
May	29	3.7	14.4	1.16	1.34	D.
June	34	.3	7.80	.629	.70	D.
July 19–31	2.2	.9	1.35	.109	.05	D.
August 1–27	5.3	1.0	2.04	.165	.17	D.




of river
of river
Full
Somerset reservoir
6
8 MILES
El. 2,100′
New England Power Co.
Empty
4
El. 2,000′
2
El. 1,900′
e of East Branch

DEERFIELD RIVER BASIN.

GENERAL FEATURES.

, the second largest tributary of Connecticut River
, rises in the towns of Stratton and Somerset, Vt.,
eral southeasterly course to its junction with Con-
ear Greenfield, Mass. In Vermont it receives the
Searsburg, the North Branch at Wilmington, and
at Readsboro. North River, entering at Shelburne
River at Greenfield are the most important tribu-
setts. The length of the river above the Massa-
is 30 miles; below the Massachusetts line the
g.

n is wooded and but little land is under cultiva-
he lower stretches. Most of the slopes are steep,
per parts of the basin exceeding 3,800 feet above

precipitation in the headwater areas of the basin
8 inches; in the lower part it is several inches
sually severe. The average depth of snowfall
ruary at Jacksonville, Vt., is about 25 inches,
ature for these months is about 18° F.

rocky slopes the river throughout its course is
l and is naturally flashy. A large storage reser-
put into use in 1913, has a marked effect on the
during the spring and summer months. A
ts has been constructed which utilizes very
of the energy of the river. The larger tribu-
sible power sites, and some additional develop-
on the main stream. A generalized profile of
late IV, and views of the gaging station at
plants near Shelburne Falls in Plates V, VI,

RIVER AT HOOSAC TUNNEL, MASS.

ay bridge near Hoosac Tunnel railroad station about
rook, 3 miles above Pelham Brook, and about 4 miles

iles.

8, 1909, to November 30, 1913; also a discharge
29, 1906.

stream side of bridge.

ade from bridge or by wading.

coarse gravel; very rough; control practically per-

imum stage recorded: 10.7 feet, 6.30 a. m., October
second-feet. Minimum stage recorded: 0.68 foot,
rge, 6 second-feet.

Winter flow.—Discharge relation seriously affected by ice.

Regulation.—Distribution of flow seriously affected by operation of numerous mills on the main river and its tributaries above the station and during 1913 by storage in a reservoir at Somerset, Vt.

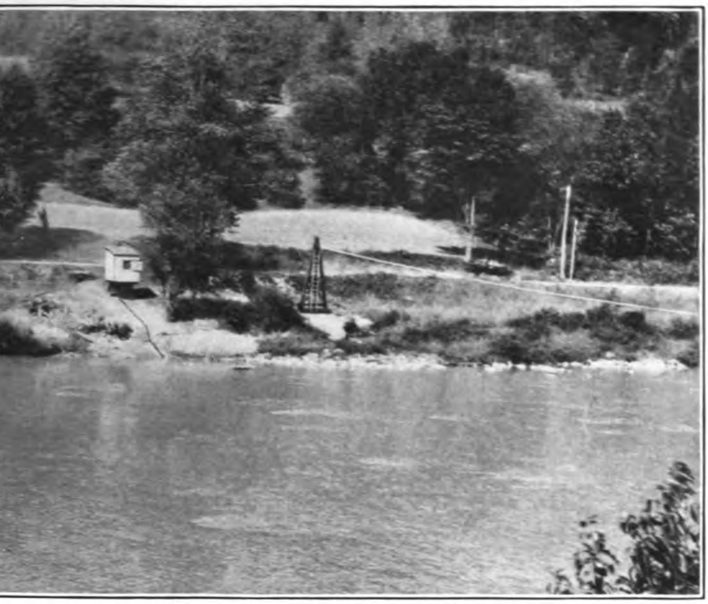
Accuracy.—Individual determinations of discharge good, but the diurnal fluctuation is so large that mean daily or monthly discharge has not been computed.

Discharge measurements of Deerfield River at Hoosac Tunnel, Mass., during 1906–1913.

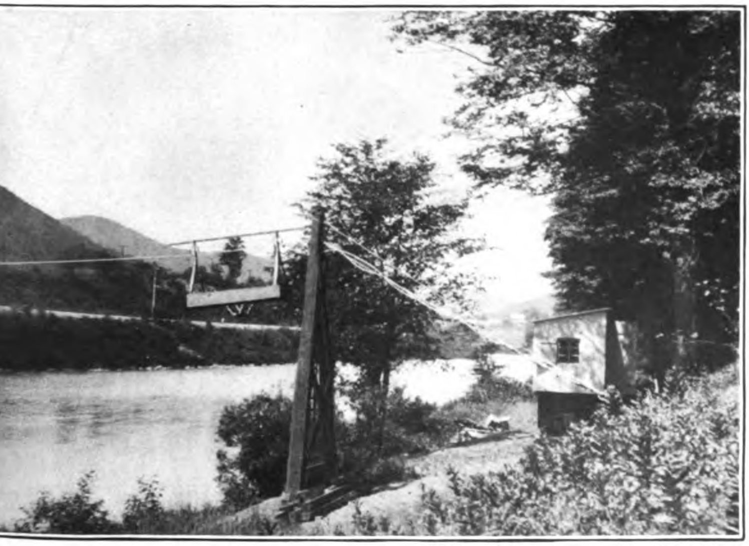
Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
1906.			
Oct. 29	F. E. Pressey		66.0
1909.			
July 27	D. M. Wood	1.75	159
Aug. 7	....do	1.95	211
27	....do	1.12	34.7
Oct. 5	....do	1.94	207
5	T. W. Norcross	1.94	209
Dec. 16	D. M. Wood	a2.69	272
1910.			
Feb. 16	D. M. Wood	a2.36	328
Mar. 1	....do	6.92	b6,410
4	T. W. Norcross	4.02	b1,720
8	D. M. Wood	4.01	b1,590
25	....do	5.37	b3,390
Apr. 28	....do	5.15	b3,130
Sept. 16	W. G. Hoyt	1.40	85.5
Oct. 25	C. C. Covert	1.45	107
Dec. 29	W. G. Hoyt	a1.26	34.0
1911.			
Jan. 12	F. J. Shuttleworth	a2.42	397
31	....do	a2.47	417
Mar. 6	....do	a1.92	169
1911.			
Mar. 21	F. J. Shuttleworth	a2.03	218
31	C. C. Covert	3.32	1,060
Apr. 25	C. S. De Golyer	4.41	2,200
June 17	G. H. Canfield	2.79	700
July 13	W. G. Hoyt	1.11	44.7
13	....do	.99	27.2
13	....do	.98	25.4
Aug. 19	Frank Weber	1.86	157
20	....do	1.64	130
21	....do	1.14	50
Nov. 30	....do	3.70	1,390
1912.			
Jan. 11	C. A. Moore	a3.28	203
Feb. 15	G. H. Canfield	a3.32	241
16	....do	a2.44	123
Mar. 6	Alexander McMillan	a2.68	130
6	....do	a3.00	159
13	....do	a3.66	359
1913.			
Feb. 15	De Golyer and Barnes	a2.40	277
Mar. 14	C. S. De Golyer	4.72	2,750
Sept. 25	R. S. Barnes	1.98	217

a Discharge relation affected by ice.

b Velocity observations at 1 foot depth; coefficient of 0.90 applied.



A.



B.

VIEWS OF GAGING STATION ON DEERFIELD RIVER AT CHARLEMONT, MASS.

Winter flow.—Discharge relation seriously affected by ice.

Regulation.—Distribution of flow seriously affected by operation of numerous mills on the main river and its tributaries above the station and during 1913 by storage in a reservoir at Somerset, Vt.

Accuracy.—Individual determinations of discharge good, but the diurnal fluctuation is so large that mean daily or monthly discharge has not been computed.

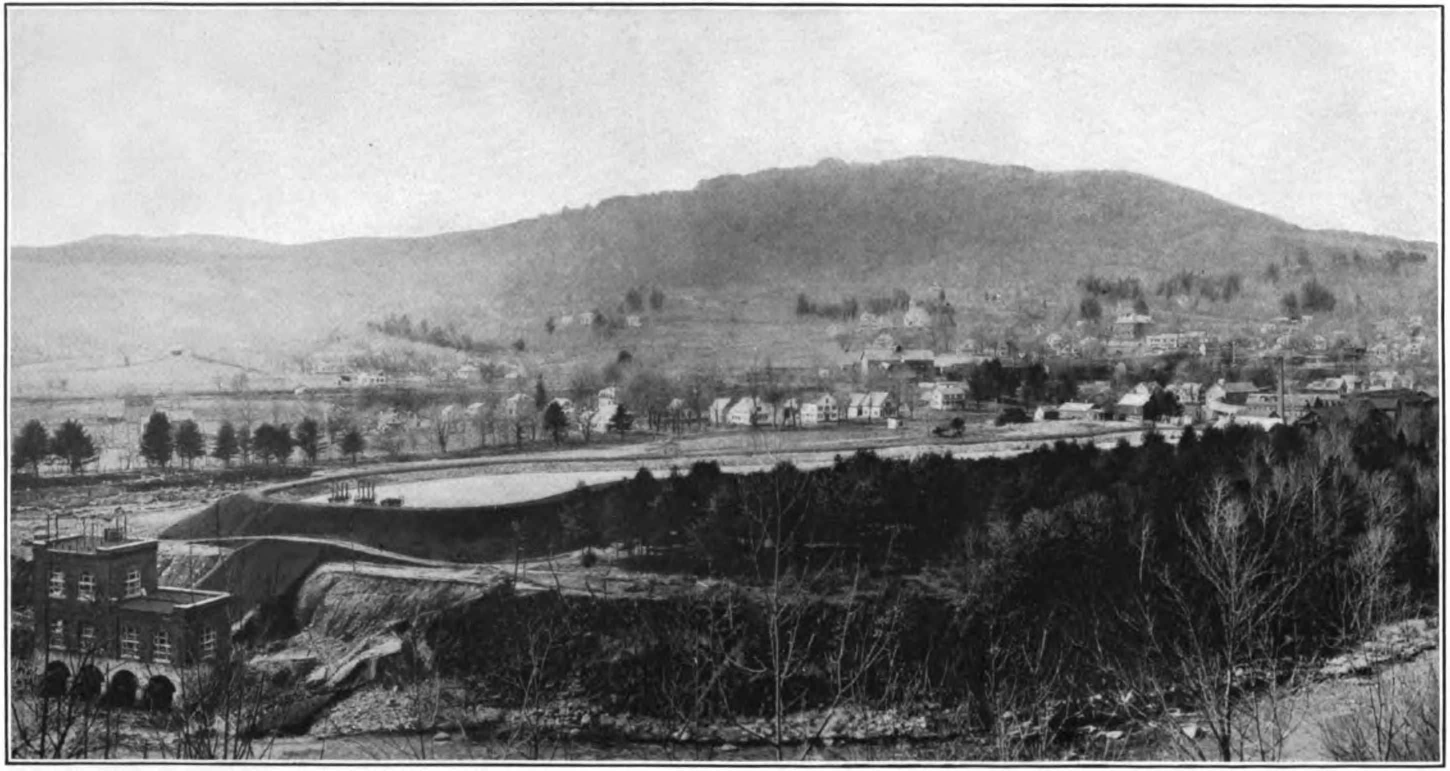
Discharge measurements of Deerfield River at Hoosac Tunnel, Mass., during 1906–1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1906.		*Feet.*	*Sec.-ft.*	1911.		*Feet.*	*Sec.-ft.*
Oct. 29	F. E. Pressey		66.0	Mar. 21	F. J. Shuttleworth	[a]2.03	218
				31	C. C. Covert	3.32	1,060
1909.				Apr. 25	C. S. De Golyer	4.41	2,200
July 17	D. M. Wood	1.75	159	June 17	G. H. Canfield	2.79	700
Aug. 7	do	1.95	211	July 13	W. G. Hoyt	1.11	44.7
27	do	1.12	34.7	13	do	.99	27.2
Oct. 5	do	1.94	207	13	do	.98	25.4
5	T. W. Norcross	1.94	209	Aug. 19	Frank Weber	1.86	157
Dec. 16	D. M. Wood	[a]2.69	272	20	do	1.64	130
				21	do	1.14	50
1910.				Nov. 30	do	3.70	1,390
Feb. 16	D. M. Wood	[a]2.36	328				
Mar. 1	do	6.92	[b]6,410	1912.			
4	T. W. Norcross	4.02	[b]1,720	Jan. 11	C. A. Moore	[a]3.28	203
8	D. M. Wood	4.01	[b]1,590	Feb. 15	G. H. Canfield	[a]3.32	241
25	do	5.37	[b]3,390	16	do	[a]2.44	123
Apr. 26	do	5.15	[b]3,130	Mar. 6	Alexander McMillan	[a]2.68	130
Sept. 16	W. G. Hoyt	1.40	85.5	6	do	[a]3.00	159
Oct. 25	C. C. Covert	1.45	107	13	do	[a]3.66	359
Dec. 19	W. G. Hoyt	[a]1.26	34.0				
				1913.			
1911.				Feb. 15	De Golyer and Barnes	[a]2.40	277
Jan. 12	F. J. Shuttleworth	[a]2.42	397	Mar. 14	C. S. De Golyer	4.72	2,750
31	do	[a]2.47	417	Sept. 25	R. S. Barnes	1.98	217
Mar. 6	do	[a]1.92	169				

[a] Discharge relation affected by ice.
[b] Velocity observations at 1 foot depth; coefficient of 0.90 applied.

A.

LD RIVER AT CHARLEMONT, MASS.



DAM, FOREBAY, AND ELECTRIC-POWER STATION OF NEW ENGLAND POWER CO. ON DEERFIELD RIVER AT SHELBURNE FALLS, MASS., NOVEMBER 10, 1912.

River at Hoosac Tunnel, Mass., for 1909–1913.

August.			September.			
.M.	P. M.		A. M.		P M.	
Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
....	....	....	7.00	28	6.00	39
....	....	....	7.00	44	6.00	40
....	....	....	7.00	39	6.00	38
....	....	....	7.00	37	6.00	36
....	....	....	7.00	28	6.00	27
....	....	....	7.00	29	6.00	34
....	3.15	221	7.00	231	6.00	185
234	6.00	103	7.00	163	6.00	145
133	6.00	84	7.00	28	6.00	199
39	6.00	67	7.00	52	6.00	173
28	6.00	39	7.00	52	6.00	90
28	6.00	67	7.00	67	6.00	27
52	6.00	84	7.00	67	6.00	234
28	6.00	39	7.00	103	6.00	103
52	6.00	28	7.00	94	6.00	84
234	6.00	398	7.00	28	6.00	39
450	6.00	860	7.00	94	6.00	103
1,190	6.00	932	7.00	39	6.00	103
852	6.00	620	7.00	94	6.00	67
374	6.00	234	7.00	72	6.00	52
215	6.00	116	7.00	52	6.00	52
99	6.00	92	7.00	39	6.00	52
88	6.00	86	7.00	39	6.00	67
81	6.00	77	7.00	202	6.00	202
58	6.00	52	7.00	202	6.00	173
39	6.00	28	7.00	160	6.00	67
28	6.00	28	7.00	84	6.00	103
29	6.00	30	7.00	704	6.00	3,490
31	6.00	34	7.00	1,640	6.00	1,180
38	6.00	150	7.00	796	6.00	780
28	6.00	111	....	....	....	....

October.			November.			
450	5.45	445	7.00	182	5.00	244
398	5.45	389	7.00	94	5.00	179
308	5.45	234	7.00	120	5.00	147
173	5.45	173	7.00	208	5.00	155
103	5.45	67	7.00	185	5.00	88
160	5.45	160	7.00	124	5.00	103
173	5.45	173	7.00	38	5.00	40
173	5.45	103	7.00	47	5.00	147
147	5.45	76	7.00	155	5.00	64
147	5.45	173	7.00	103	5.00	173
39	5.45	147	7.00	103	5.00	124
103	5.45	160	7.00	94	5.00	124
202	5.45	188	7.00	131	5.00	124
173	5.45	202	7.00	103	5.00	90
173	5.45	150	7.00	39	5.00	168
188	5.45	202	7.00	46	5.00	99
252	5.45	150	7.00	147	5.00	124
39	5.45	147	7.00	351	5.00	408
202	5.45	173	7.00	188	5.00	160
142	5.45	173	7.00	173	5.00	196
94	5.45	202	7.00	165	5.00	147
188	5.45	202	7.00	147	5.00	173
506	5.45	524	7.00	196	5.00	234
567	5.30	440	7.00	173	5.00	182
536	5.30	424	7.00	173	5.00	124
365	5.30	202	7.00	218	5.00	269
365	5.30	202	7.00	173	5.00	147
351	5.30	234	7.00	234	5.00	288
238	5.30	202	7.00	342	5.00	450
202	5.30	90	7.00	398	5.00	252
39	5.00	28	....	....	....	....

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	December.				March.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1909–10.								
1	7.00	234	5.00	238				
2	7.00	218	5.00	142	7.00	4,500	4.30	3,340
3	7.00	212	5.00	173	7.00	3,040	4.30	2,890
4	7.00	330	5.00	234	7.00	1,670	6.00	1,660
5	7.00	173	5.00	103	7.00	1,560	6.00	1,570
6	7.00	173	5.00	160	7.00	1,460	1.00	1,650
7	7.00	103	5.00	131	7.00	1,560	1.00	1,360
8	7.00	147	5.00	136	7.00	1,660	6.00	1,560
9	7.00	202	5.00	188	7.00	1,360	6.00	1,180
10	7.00	84	5.00	114	7.00	780	6.00	704
11					7.00	668	6.00	633
12					7.00	633	6.00	567
13					7.00	600	6.00	506
14					7.00	580	6.00	567
15					7.00	506	6.00	506
16					7.00	450	6.00	450
17					7.00	704	4.30	712
18					7.00	697	5.00	683
19					7.00	676	5.00	690
20					7.00	561	5.00	574
21					7.00	633	5.00	600
22					7.00	561	5.00	593
23					7.00	1,660	5.00	1,970
24					7.00	2,230	5.00	2,110
25					7.00	2,890	5.00	3,040
26					7.00	3,310	5.00	3,610
27					7.00	2,750	5.00	2,680
28					7.00	2,610	5.00	2,750
29					7.00	2,610	5.00	2,480
30					7.00	2,750	5.00	3,040
31					7.00	3,190	5.00	3,260

Day.	April.				May.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1910.								
1	7.00	3,340	5.00	3,460	7.00	613	6.00	613
2	7.00	2,890	5.00	2,480	7.00	647	6.00	742
3	7.00	2,750	5.00	2,610	7.00	757	6.00	683
4	7.00	2,050	5.00	1,880	7.00	683	6.00	613
5	7.00	1,770	5.00	1,820	7.00	683	6.00	757
6	7.00	2,480	5.00	2,540	7.00	549	6.00	489
7	7.00	2,570	5.00	2,350	7.00	757	6.00	683
8	7.00	1,660	5.00	1,560	7.00	489	6.00	434
9	7.00	1,360	5.00	1,270	7.00	434	6.00	408
10	7.00	940	5.00	820	7.00	549	6.00	580
11	7.00	780	5.00	788	7.00	549	6.00	489
12	7.00	780	5.00	780	7.00	461	6.00	434
13	7.00	704	5.00	668	7.00	434	6.00	384
14	7.00	633	5.00	640	7.00	258	6.00	296
15	7.00	506	5.00	450	7.00	338	6.00	360
16	7.00	424	5.00	450	7.00	434	6.00	384
17	7.00	506	6.00	536	7.00	360	6.00	408
18	7.00	450	6.00	478	7.00	757	6.00	796
19	7.00	1,410	6.00	1,430	7.00	757	6.00	683
20	7.00	1,180	6.00	1,100	7.00	613	6.00	489
21	7.00	780	6.00	820	7.00	518	6.00	549
22	7.00	860	6.00	820	7.00	683	6.00	613
23	7.00	780	6.00	780	7.00	549	6.00	518
24	7.00	567	6.00	506	7.00	489	6.00	549
25	7.00	450	6.00	633	7.00	613	6.00	757
26	7.00	3,440	6.00	3,830	7.00	1,160	6.00	1,850
27	7.00	3,000	6.00	2,850	7.00	1,630	6.00	1,430
28	7.00	1,960	6.00	1,850	7.00	757	6.00	683
29	7.00	1,080	6.00	1,000	7.00	580	6.00	580
30	7.00	757	6.00	683	7.00	518	6.00	549
31					7.00	1,080	6.00	1,120

ON OF NEW ENGLAND POWER CO. ON DEERFIELD RIVER
ELBURNE FALLS, MASS., JUNE 4, 1913.

LIGHT & POWER CO. ON DEERFIELD RIVER AT
ELBURNE FALLS, MASS., NOVEMBER 27, 1911.

at Hoosac Tunnel, Mass., for 1909–1913—
nued.

une.			July.			
	P. M.		A. M.		P. M.	
e.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
00	6.00	1,080	7.00	118	6.00	129
00	6.00	916	7.00	224	6.00	97
86	6.00	757	7.00	88	6.00	97
49	6.00	489	7.00	193	6.00	36
18	6.00	489	7.00	48	6.00	46
89	6.00	461	7.00	129	6.00	97
34	6.00	489	7.00	118	6.00	97
18	6.00	549	7.00	97	6.00	97
57	6.00	916	7.00	88	6.00	97
80	6.00	1,530	7.00	55	6.00	118
80	6.00	1,430	7.00	118	6.00	88
80	6.00	1,040	7.00	36	6.00	42
16	6.00	916	7.00	46	6.00	55
58	6.00	916	7.00	79	6.00	62
16	6.00	757	7.00	97	6.00	97
47	6.00	683	7.00	25	6.00	36
19	6.00	836	7.00	48	6.00	62
60	6.00	1,160	7.00	30	6.00	152
57	6.00	613	7.00	150	6.00	97
49	6.00	434	7.00	27	6.00	48
84	6.00	384	7.00	62	6.00	62
38	6.00	296	7.00	97	6.00	48
24	6.00	224	7.00	62	6.00	66
241	6.00	224	7.00	62	6.00	62
24	6.00	228	7.00	55	6.00	48
224	6.00	224	7.00	97	6.00	107
24	6.00	224	7.00	152	6.00	140
193	6.00	165	7.00	118	6.00	118
152	6.00	118	7.00	118	6.00	118
97	6.00	97	7.00	97	6.00	88
....	....	....	7.00	70	6.00	208

August.			September.			
62	6.00	97	7.00	21	6.00	97
107	6.00	97	7.00	25	6.00	36
107	6.00	97	7.00	42	6.00	36
118	6.00	124	7.00	42	6.00	36
129	6.00	97	7.00	42	0.00	48
79	6.00	70	7.00	461	6.00	489
79	6.00	79	7.00	580	6.00	580
36	6.00	107	7.00	384	6.00	317
88	6.00	88	7.00	224	6.00	118
62	6.00	70	7.00	118	6.00	118
79	6.00	224	7.00	97	6.00	88
118	6.00	193	7.00	79	6.00	224
241	6.00	224	7.00	152	6.00	118
152	6.00	140	7.00	118	6.00	107
88	6.00	79	7.00	97	6.00	25
62	6.00	88	7.00	79	6.00	25
107	6.00	48	7.00	28	6.00	19
25	6.00	48	7.00	39	6.00	34
97	6.00	97	7.00	52	6.00	60
118	6.00	79	7.00	84	6.00	67
[illegible]	6.00	62	7.00	34	6.00	28
[illegible]	6.00	60	7.00	94	6.00	94
[illegible]	6.00	42	7.00	84	6.00	84
[illegible]	.00	42	7.00	84	6.00	67
[illegible]	00	42	7.00	28	6.00	19
[illegible]	.00	36	7.00	84	6.00	94
[illegible]	.00	30	7.00	84	6.00	94
[illegible]	.00	25	7.00	94	6.00	103
	6.00	25	7.00	103	6.00	124
	6.00	36	7.00	147	6.00	218
	6.00	25	....	....	....	....

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	October.				November.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1910.								
1	7.00	103	5.30	84	7.00	103	5.00	124
2	7.00	67	5.30	67	7.00	124	5.00	124
3	7.00	52	5.30	34	7.00	136	5.00	136
4	7.00	28	5.30	28	7.00	450	5.00	780
5	7.00	28	5.30	28	7.00	820	5.00	780
6	7.00	84	5.30	103	7.00	704	5.00	668
7	7.00	84	5.30	67	7.00	424	5.00	398
8	7.00	67	5.30	76	7.00	252	5.00	398
9	7.00	76	5.30	76	7.00	308	5.00	234
10	7.00	39	5.30	39	7.00	160	5.00	124
11	7.00	39	5.30	34	7.00	234	5.00	234
12	7.00	103	5.30	84	7.00	202	5.00	202
13	7.00	103	5.30	103	7.00	188	5.00	188
14	7.00	84	5.30	67	7.00	234	5.00	252
15	7.00	84	5.30	67	7.00	234	5.00	136
16	7.00	76	5.30	52	7.00	234	5.00	234
17	7.00	39	6.00	103	7.00	202	5.00	147
18	7.00	94	6.00	67	7.00	136	5.00	136
19	7.00	28	6.00	19	7.00	147	5.00	136
20	7.00	39	6.00	39	7.00	147	5.00	147
21	7.00	39	6.00	39	7.00	136	5.00	124
22	7.00	84	5.00	94	7.00	124	5.00	124
23	7.00	94	5.00	124	7.00	124	5.00	124
24	7.00	202	5.00	124	7.00	136	5.00	124
25	7.00	114	5.00	103	7.00	124	5.00	114
26	7.00	136	5.00	103	7.00	103	5.00	103
27	7.00	114	5.00	103	7.00	147	5.00	160
28	7.00	114	5.00	188	7.00	173	5.00	188
29	7.00	351	5.00	308	7.00	234	5.00	202
30	7.00	202	5.00	160	7.00	173	5.00	188
31	7.00	52	5.00	351	7.00	....	5.00	

Day.	December.				April.			
1910–11.								
1	7.00	114	5.00	114	7.50	719	5.40	620
2	7.00	124	5.00	103	7.30	440	5.30	495
3	7.00	124	5.00	103	7.25	398	5.40	555
4	7.00	124	5.00	94	7.20	300	5.45	450
5	7.00	124	5.00	84	7.50	317	5.20	440
6	7.00	103	5.00	84	7.35	765	5.25	2,900
7	7.00	103	5.00	76	7.30	4,460	5.45	5,250
8	7.00	124	5.00	103	7.35	3,160	5.50	3,160
9	7.00	136	5.00	103	7.40	2,210	5.35	1,970
10	7.00	124	5.00	103	7.20	1,440	5.15	1,340
11	7.00	103	5.00	84	7.20	1,000	6.55	1,250
12	7.00	94	5.00	94	7.50	924	5.30	1,080
13	7.00	124	5.00	124	7.15	1,080	5.35	1,540
14	7.00	147	5.00	147	7.35	1,750	5.25	2,330
15	7.00	124	5.00	103	7.20	4,460	5.50	3,770
16	7.00	103	5.00	94	7.30	4,100	5.30	2,330
17	7.00	94	5.00	114	7.45	2,090	5.45	1,750
18	7.00	94	5.00	124	7.30	1,440	5.25	1,340
19	7.00	124	5.00	124	7.50	1,340	5.50	1,440
20	7.00	124	5.00	124	7.45	1,250	5.20	1,440
21	....	....	....	....	7.30	1,160	5.45	1,540
22	....	....	....	....	7.15	1,640	5.55	1,340
23	....	....	....	....	7.35	1,440	5.35	1,250
24	....	....	....	....	7.50	1,160	6.00	1,440
25	....	....	....	....	7.20	2,110	5.30	2,250
26	....	....	....	....	7.20	2,860	5.25	2,610
27	....	....	....	....	7.15	3,160	5.15	3,040
28	....	....	....	....	7.25	3,720	6.10	4,310
29	....	....	....	....	7.35	3,770	6.30	4,130
30	....	....	....	....	7.45	3,340	5.20	2,780

at Hoosac Tunnel, Mass., for 1909–1913—
inued.

May.			June.			
	P. M.		A. M.		P. M.	
s- ge.	Time.	Dis- charge.	Time.	Dis- charge.	Time.	Dis- charge.
040	5.45	2,720	7.40	147	5.45	342
150	5.45	4,460	7.35	408	5.40	342
360	5.45	2,330	7.45	196	5.45	218
360	5.45	1,540	7.30	262	5.35	152
440	5.50	1,340	7.30	99	5.40	208
250	5.50	1,040	7.35	129	5.30	142
765	6.00	495	7.30	317	5.30	1,440
765	5.50	262	7.30	1,200	5.25	920
567	5.45	620	7.35	555	5.30	518
506	5.40	450	7.30	495	5.40	461
317	5.35	374	7.45	389	5.30	342
389	5.55	351	7.40	567	5.30	690
450	5.25	440	7.35	3,010	5.35	2,210
351	5.45	342	7.35	1,750	5.35	1,340
317	5.45	300	7.40	1,080	5.35	1,000
360	5.50	262	7.35	1,000	5.40	690
269	5.30	228	7.20	620	5.30	567
234	5.30	147	7.40	440	5.30	408
300	5.45	440	7.30	351	5.40	308
351	5.40	360	7.30	360	5.30	330
360	5.30	300	7.35	308	5.30	269
374	5.40	317	7.30	202	5.30	288
300	5.35	228	7.30	173	5.30	234
234	5.30	262	7.35	103	5.40	188
208	5.50	277	7.40	67	5.30	103
228	5.30	317	7.30	196	5.30	234
262	5.35	228	7.30	208	5.30	398
179	5.40	173	7.35	218	5.30	269
168	5.30	103	7.30	202	5.25	173
99	5.35	103	7.30	228	5.30	103
103	5.40	228	....	....	....	....
July.			August.			
103	5.30	107	7.30	76	5.35	76
147	5.45	39	7.30	94	5.30	70
67	4.00	147	7.35	76	5.35	67
173	5.40	52	7.35	94	5.30	76
28	5.30	103	7.30	60	5.30	46
88	5.30	107	7.30	24	5.30	34
28	5.35	99	7.30	60	5.30	76
34	5.30	84	7.30	64	5.30	60
28	5.35	67	7.30	136	5.30	84
28	5.40	94	7.30	70	5.40	76
114	5.35	67	7.30	60	5.30	46
28	5.40	103	7.30	81	5.30	81
67	5.35	19	7.30	60	5.30	94
39	5.30	136	7.30	24	5.30	76
30	5.30	107	7.30	34	5.30	24
28	5.30	52	7.30	288	5.30	218
30	5.30	28	7.30	160	5.30	84
103	5.30	52	7.30	94	5.30	94
88	5.30	30	7.30	84	5.30	288
84	5.35	84	7.45	142	5.30	88
28	5.40	52	7.30	39	5.30	179
94	5.35	52	7.30	107	5.30	81
28	5.30	28	7.30	24	5.30	81
39	5.30	103	7.30	76	5.30	24
103	5.30	506	7.30	94	5.30	103
269	5.30	351	7.45	67	5.30	202
103	5.30	103	7.30	188	5.30	94
88	5.30	103	7.30	94	5.30	188
107	5.30	351	7.30	2,820	5.30	1,610
55	5.30	269	7.30	844	5.30	536
173	5.30	234	7.30	424	5.30	389

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	September.				October.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
1911.								
1	7.30	277	5.30	351	7.30	704	5.40	647
2	7.30	208	5.30	160	7.30	1,720	5.30	1,510
3	7.40	234	5.30	506	7.30	1,140	5.30	980
4	7.30	398	5.30	330	7.30	668	5.30	2,820
5	7.30	218	5.30	288	7.30	2,110	4.00	1,580
6	7.30	234	5.30	980	8.00	1,040	4.00	940
7	7.30	940	5.30	668	8.00	860	4.00	876
8	7.30	536	5.30	1,140	7.00	1,060	3.30	1,000
9	7.30	900	5.30	4,040	8.00	1,020	4.00	956
10	7.30	2,290	5.30	1,460	8.00	924	4.00	820
11	7.30	1,020	5.30	704	8.00	647	4.00	620
12	7.30	478	5.30	424	8.00	495	4.00	506
13	7.30	398	5.30	330	8.00	398	4.00	424
14	7.30	252	5.30	277	8.00	342	4.00	317
15	7.30	136	5.30	424	7.00	351	2.30	360
16	7.30	820	5.30	742	8.00	277	4.00	330
17	7.30	600	5.30	424	8.00	269	4.00	277
18	7.30	351	5.30	288	8.00	342	4.00	3,340
19	7.30	252	5.30	308	8.00	7,650	4.00	6,040
20	7.30	277	5.30	188	8.00	3,640	4.00	2,860
21	7.30	288	5.30	160	8.00	1,990	4.00	2,050
22	7.30	308	5.30	478	7.00	3,460	3.00	2,860
23	7.30	506	5.30	424	8.00	3,310	4.00	3,040
24	7.45	269	5.30	478	8.00	1,990	4.00	1,770
25	7.30	450	5.30	374	8.00	1,320	4.00	1,120
26	7.30	351	5.30	288	8.00	940	4.00	924
27	7.30	288	5.30	262	8.00	719	4.00	704
28	7.30	398	5.30	408	8.00	600	4.00	580
29	7.30	351	5.30	506	7.00	536	3.00	506
30	7.30	1,410	5.30	1,060	8.00	450	4.00	440
31	....	....	....	....	8.00	440	4.00	536
	November.				December.			
1	8.00	1,060	4.00	940	8.00	980	4.00	780
2	8.00	780	4.00	690	8.00	704	4.00	742
3	8.00	506	4.00	518	7.00	518	3.00	450
4	8.00	580	4.00	506	8.00	360	4.00	351
5	7.00	342	3.00	398	8.00	317	4.00	300
6	8.00	389	4.00	450	8.00	374	4.00	288
7	8.00	940	4.00	980	8.00	374	4.00	342
8	8.00	1,220	4.00	1,120	8.00	424	4.00	389
9	8.00	860	4.00	780	8.00	288	4.00	374
10	8.00	690	4.00	765	7.00	398	3.00	424
11	8.00	820	4.00	844	8.00	408	4.00	342
12	7.00	742	3.00	567	8.00	633	4.00	742
13	8.00	1,540	4.00	1,120	8.00	844	4.00	876
14	8.00	860	4.00	820	8.00	780	4.00	742
15	8.00	765	4.00	742	8.00	668	4.00	690
16	8.00	555	4.00	633	8.00	668	4.00	765
17	8.00	495	4.00	440	7.30	1,270	3.00	1,460
18	8.00	668	4.00	1,940	8.00	1,080	4.00	940
19	7.00	1,880	3.00	1,560	8.00	536	4.00	567
20	8.00	1,180	4.00	1,140	8.00	398	4.00	351
21	8.00	956	4.00	704	8.00	317	4.00	389
22	8.00	647	4.00	580	8.00	450	4.00	478
23	8.00	450	4.00	478	8.00	1,880	4.00	4,990
24	8.00	620	4.00	647	7.00	2,420	12.20	2,230
25	8.00	600	4.00	567	7.00	1,660	1.10	1,560
26	7.00	450	3.00	408	7.00	1,270	12.45	1,180
27	8.00	360	4.00	389	7.00	1,660	1.10	1,270
28	8.00	440	4.00	408	7.00	1,180	1.10	1,100
29	8.00	2,820	4.00	2,230	8.00	360	4.00	351
30	8.00	1,380	4.00	1,250	8.00	424	4.00	461
31	....	....	....	....	7.00	450	3.00	374

ver at Hoosac Tunnel, Mass., for 1909–1913—
ntinued.

January.			February.			
I.	P. M.		A. M.		P. M.	
Dis- harge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
424	4.00	440	....	....	....	....
351	4.00	360	....	....	....	....
374	4.00	360	....	....	....	....
317	4.00	308	....	....	....	....
277	4.00	342	....	....	....	....
....	....	....	....	....	....	....
....	....	....	....	....	....	....
144	....	....	....	....	....	....
....	....	....	....	....	....	....
....	....	....	....	....	....	....
....	....	....	....	....	....	....
....	....	....	....	....	....	....
....	....	....	....	....	....	....
....	2.00	160	....	....	....	....
....	....	....	....	....	3.00	254
....	....	....	....	....	3.00	240
....	....	....	....	....	3.00	207
207	5.00	160	....	....	3.00	180
....	2.00	228	....	....	3.00	197
372	12.00	690	....	....	3.00	166
513	....	....	....	....	3.00	160
....	....	....	....	....	3.00	267
....	....	....	....	....	3.00	282
....	....	....	....	....	3.00	352
298	....	....	....	....	3.00	316
....	....	....	....	....	3.00	298
267	....	....	....	....	3.00	316
....	....	....	....	....	3.00	298
....	....	....	....	....	3.00	316
....	....	....	....	....	....	....
....	....	....	....	....	....	....

March.				April.			
..	....	3.00	267	7.00	3,800	5.00	3,490
..	....	3.00	282	7.00	2,610	5.00	2,890
..	....	3.00	273	7.00	2,230	5.00	1,770
..	....	3.00	282	7.00	1,180	5.00	860
..	....	3.00	217	7.00	1,020	5.00	1,360
..	....	3.00	156	7.00	3,490	5.00	5,290
..	....	3.00	120	7.00	4,690	6.00	8,010
00	135	3.00	129	7.00	6.370	5.00	2,640
00	144	3.00	137	7.00	4,310	5.00	2,640
00	173	3.00	240	7.00	1,880	5.30	1,720
00	135	3.00	201	7.00	1,440	5.30	1,460
00	154	3.00	129	7.30	1,320	5.00	1,100
00	298	3.00	333	7.00	1,360	5.30	1,460
00	757	3.00	627	7.00	1,560	5.00	2,110
00	568	3.00	903	7.00	1,970	5.00	2,230
00	3,960	3.00	2,750	7.00	3,800	5.00	6,040
00	1,970	3.00	1,770	7.00	5,090	5.00	4,500
00	1,660	3.00	1,940	7.00	3,340	6.00	3,340
00	1,880	3.00	1,990	7.00	3,260	5.00	2,820
00	2,350	3.00	2,890	7.00	2,110	6.00	1,990
.00	1,770	3.00	1,460	7.00	1,660	6.00	1,560
.00	1,140	3.00	980	7.00	2,010	5.00	2,230
.00	742	3.00	600	7.00	3,340	6.00	3,040
.00	495	3.00	633	7.00	2,480	6.00	2,450
.00	518	3.00	424	7.00	1,180	3.00	1,360
.00	317	5.00	506	7.00	1,460	5.00	1,270
.00	450	5.00	398	7.00	1,460	5.00	1,250
.00	374	5.00	536	7.00	1,320	6.00	1,270
7.00	620	5.00	1,880	7.00	1,180	5.00	1,100
7.00	2,350	5.00	2,050	7.00	1,020	5.00	980
7.00	1,720	5.30	1,990	....	....	....	....

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	May.				June.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1912.								
1	7.00	900	5.00	1,020	7.00	2,450	5.00	1,360
2	7.00	860	5.00	780	7.00	1,100	5.00	900
3	7.00	633	5.00	580	7.00	6,150	5.00	2,890
4	7.00	506	5.00	351	7.00	1,770	6.00	1,410
5	7.00	269	5.00	506	7.00	1,480	6.00	1,270
6	7.00	956	5.00	1,460	7.00	1,020	5.00	1,560
7	7.00	1,270	5.00	1,120	7.00	1,460	5.00	1,410
8	7.00	940	6.00	780	7.00	1,100	5.00	1,020
9	7.00	780	6.00	1,020	7.00	450	6.00	633
10	7.00	668	6.00	780	7.00	506	6.00	495
11	7.00	633	6.00	600	7.00	567	5.00	424
12	7.00	450	5.00	506	7.00	360	5.00	321
13	7.00	567	6.00	780	7.00	218	5.00	300
14	7.00	1,100	6.00	860	7.00	234	5.00	188
15	7.00	704	5.00	690	7.00	142	5.00	160
16	7.00	567	6.00	567	7.00	202	5.00	160
17	7.00	4,130	6.00	3,800	7.00	179	5.00	330
18	7.00	2,050	6.00	1,510	7.00	173	5.00	173
19	7.00	1,140	6.00	980	7.00	168	5.00	173
20	7.00	860	6.00	820	7.00	84	5.00	129
21	7.00	1,020	7.00	980	7.00	103	5.00	84
22	7.00	1,560	6.30	1,270	7.00	76	5.00	103
23	7.00	1,180	7.00	940	7.00	28	5.00	136
24	7.00	860	6.30	1,020	7.00	64	5.00	103
25	7.00	940	5.00	780	7.00	67	5.00	84
26	7.00	633	6.30	567	7.00	67	5.00	72
27	7.00	536	5.00	495	7.00	64	5.00	94
28	7.00	398	6.00	506	7.00	70	5.00	52
29	7.00	351	6.00	450	7.00	46	5.00	64
30	7.00	4,130	6.00	4,130	7.00	28	5.00	30
31	7.00	2,890	6.00	2,610	....	....	....	....
	July.				August.			
1	7.00	60	5.00	99	7.00	67	5.00	60
2	7.00	55	5.00	81	7.00	49	5.00	19
3	7.00	39	5.00	84	7.00	19	5.00	11
4	7.00	76	5.00	8	7.00	28	5.00	12
5	7.00	19	5.00	12	7.00	147	5.00	39
6	7.00	12	5.00	7	7.00	107	5.00	103
7	7.00	6	5.00	173	7.00	67	5.00	52
8	7.00	168	5.00	114	7.00	12	5.00	28
9	7.00	94	5.00	84	7.00	19	5.00	34
10	7.00	76	5.00	67	7.00	12	5.00	34
11	7.00	67	5.00	84	7.00	46	5.30	633
12	7.00	84	5.00	52	7.00	351	5.00	330
13	7.00	64	5.00	103	7.00	202	5.00	160
14	7.00	84	5.00	39	7.00	142	5.00	114
15	7.00	147	5.00	202	7.00	64	5.00	84
16	7.00	173	5.00	124	7.00	76	5.00	28
17	7.00	84	5.00	76	7.00	12	5.00	28
18	7.00	52	5.00	147	7.00	52	5.00	28
19	7.00	424	5.00	234	7.00	269	5.00	234
20	7.00	202	5.00	168	7.00	308	5.00	269
21	7.00	124	5.00	52	7.00	188	5.00	168
22	7.00	147	5.00	269	7.00	90	5.00	103
23	7.00	124	5.00	94	7.00	67	5.00	269
24	7.00	99	5.00	103	7.00	450	5.00	374
25	7.00	76	5.00	64	7.00	234	5.00	252
26	7.00	81	5.00	94	7.00	450	5.00	440
27	7.00	67	5.00	81	7.00	478	5.00	202
28	7.00	39	5.00	19	7.00	173	6.00	202
29	7.00	12	5.00	12	7.00	202	6.00	234
30	7.00	7	5.00	28	7.00	228	5.00	160
31	7.00	67	5.00	84	7.00	19	5.00	76

d River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

September.			October.			
A. M.	P. M.		A. M.		P. M.	
Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
64	5.00	39	7.00	308	5.00	269
81	5.00	114	7.00	234	5.00	308
99	5.00	99	7.00	269	5.00	234
440	5.00	269	7.00	218	5.00	234
228	5.00	188	7.00	179	5.00	173
188	5.00	228	7.00	147	5.00	168
202	5.00	188	7.00	136	5.00	94
103	5.00	94	7.00	124	5.00	99
124	5.00	99	7.00	84	5.00	136
114	5.00	94	7.00	76	5.00	103
67	5.00	81	7.00	160	5.00	450
28	5.00	76	7.00	567	5.00	536
52	5.00	28	7.00	398	5.00	450
49	5.00	60	7.00	360	5.00	308
28	5.00	12	7.00	317	5.00	234
173	5.00	1,140	7.00	188	5.00	142
506	5.00	424	7.00	160	5.00	147
269	5.00	188	7.00	173	5.00	179
173	5.00	168	7.00	188	5.00	450
103	5.00	136	7.00	269	5.00	234
202	5.00	269	7.00	288	5.00	269
252	5.00	234	7.00	269	5.00	188
202	5.00	188	7.00	103	5.00	5,500
179	5.00	168	6.30	17,200	5.00	8,250
136	5.00	103	7.00	4,690	5.00	3,640
76	5.00	99	7.00	3,260	5.00	2,290
67	5.00	39	7.00	3,190	5.00	2,230
103	5.00	76	7.00	1,100	5.00	940
39	5.00	49	7.00	780	5.00	704
269	5.00	234	7.00	633	5.00	234
....	....	....	7.00	103	5.00	351
November.			December.			
506	5.00	704	7.00	269	4.30	308
1,180	5.00	780	7.00	351	4.30	600
567	5.00	450	7.00	4,170	4.30	2,230
398	5.00	374	7.00	1,770	4.30	1,270
398	5.00	374	7.00	1,020	4.30	860
351	5.00	398	7.00	1,180	4.30	1,140
450	5.00	506	7.00	1,200	4.30	1,100
3,800	5.00	2,170	7.30	1,180	4.30	980
1,560	5.00	1,270	7.30	860	4.30	704
1,060	5.00	780	7.30	633	4.30	506
704	5.00	633	7.30	478	4.30	580
506	5.00	450	7.30	424	4.30	450
461	5.00	780	7.30	374	4.30	351
1,770	5.00	1,360	7.30	351	4.30	398
780	5.00	567	8.00	308	4.30	269
495	5.00	780	8.00	398	4.30	374
704	5.00	633	8.00	351	4.30	269
600	5.00	555	8.00	202	4.30	188
424	5.00	450	8.00	234	4.30	1,180
424	5.00	440	8.00	860	4.30	780
398	5.00	450	8.00	668	4.30	506
440	5.00	424	8.00	398	4.30	374
424	5.00	360	8.00	424	4.30	351
308	5.00	351	8.00	351	4.30	330
408	4.30	351	8.00	308	4.30	300
330	4.30	308	8.00	308	4.30	317
308	4.30	269	8.00	269	4.30	351
288	4.30	269	8.00	288	4.30	308
269	4.30	288	8.00	351	4.30	300
252	4.30	234	8.00	374	4.30	780
....	....	....	8.00	1,990	4.30	1,460

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	January.				February.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1913.								
1	8.00	1,270	4.30	1,180	8.00	1,770	4.30	1,560
2	8.00	1,020	4.30	980	8.00	1,140	4.30	820
3	8.00	780	4.30	940	8.00	1,020	4.30	980
4	8.00	1,020	4.30	980	8.00	1,460	4.30	1,180
5	8.00	1,180	4.30	1,100	8.00	1,320	4.30	1,120
6	8.00	1,100	4.30	1,020	8.00	1,180	4.30	1.100
7	8.00	1,180	4.30	2,750	8.00	1,180	4.30	780
8	8.00	2,230	4.30	2,050	8.00	1,140	4.30	1,180
9	8.00	1,770	4.30	1,320	8.00	1,020	4.30	620
10	8.00	1,180	4.30	1,060	8.00	374	4.30	450
11	8.00	1,020	4.30	1,100	8.00	330	4.30	308
12	8.00	1,660	4.30	1,480	8.00	351	4.30	351
13	8.00	1,410	4.30	1,360	8.00	241	4.30	234
14	8.00	1,060	4.30	940	8.00	....	4.30	....
15	8.00	924	4.30	980	8.00	....	4.30	....
16	8.00	780	4.30	900	8.00	....	4.30	....
17	8.00	1,510	4.30	2,750	8.00	....	4.30	....
18	8.00	4,040	4.30	3,560	8.00	....	4.30	....
19	8.00	3,190	4.30	2,820	8.00	....	4.30	....
20	8.00	1,940	4.30	1,820	8.00	....	4.30	....
21	8.00	2,890	4.30	2,230	8.00	....	4.30	....
22	8.00	1,770	4.30	1,660	8.00	....	4.30	....
23	8.00	1,180	4.30	1,660	8.00	....	4.30	....
24	8.00	1,770	4.30	1,320	8.00	....	4.30	....
25	8.00	1,020	4.30	1,000	8.00	....	4.30	....
26	8.00	940	4.40	820	7.30	....	4.30	....
27	8.00	860	4.30	780	7.30	....	4.30	....
28	8.00	668	4.30	506	7.30	....	4.30	....
29	8.00	398	4.30	330	....	....	....	....
30	8.00	324	4.30	360	....	....	....	....
31	8.00	398	4.30	308	....	....	....	....
	March.				April.			
1	....	....	....	....	7.00	1,180	5.00	1,100
2	....	....	....	....	7.00	1,020	5.00	1,140
3	....	....	....	....	7.00	1,100	5.00	900
4	....	....	....	....	7.00	860	5.00	900
5	....	....	....	....	7.00	980	5.00	1,410
6	....	....	....	....	7.00	1,060	5.00	980
7	....	....	....	....	7.00	900	5.00	780
8	....	....	....	....	7.00	600	5.00	567
9	....	....	4.30	1,540	7.00	567	5.00	351
10	8.00	1,270	5.00	1,140	7.00	269	5.00	308
11	8.00	742	4.30	633	7.00	450	5.00	1,990
12	8.00	506	4.30	780	7.00	3,040	5.00	2,680
13	7.30	742	5.00	567	7.00	1,060	5.00	980
14	7.30	668	5.00	6,150	7.00	2,050	5.00	1,410
15	7.00	4,400	5.00	3,040	7.00	860	5.00	1,270
16	7.00	3,880	5.00	2,350	7.00	1,140	5.00	980
17	7.00	1,360	5.00	1,180	7.00	1,020	5.00	780
18	7.00	1,460	5.00	940	7.00	704	5.00	668
19	7.00	780	5.00	860	7.00	567	5.00	536
20	7.00	780	5.00	4,130	7.00	600	5.00	536
21	7.00	2,750	5.00	4,130	7.00	555	5.00	536
22	7.00	2,960	5.00	2,750	7.00	478	5.00	450
23	7.00	2,680	5.00	1,660	7.00	461	5.00	440
24	7.00	1,360	5.00	4,400	7.00	478	5.00	450
25	7.00	3,040	5.00	2,750	7.00	398	5.00	424
26	7.00	4,690	5.00	9,660	7.00	424	5.00	374
27	7.00	6,830	6.00	16,600	7.00	450	5.00	506
28	7.00	6,830	5.00	4,690	7.00	450	5.00	424
29	7.00	2,480	5.00	2,350	7.00	1,660	5.00	1,610
30	7.00	1,360	5.00	1,100	7.00	1,020	5.00	820
31	7.00	1,360	5.00	1,270	....	....	....	....

ield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

May.				June.			
A. M.		P. M.		A. M.		P. M.	
me.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
7.00	536	5.00	450	7.00	1,020	5.00	1,020
7.00	398	5.00	360	7.00	860	5.00	780
7.00	450	5.00	440	7.00	860	5.00	704
7.00	374	5.00	398	7.00	450	5.00	398
7.00	330	5.30	374	7.00	351	5.00	269
7.00	308	5.00	277	7.00	288	5.00	202
7.00	288	5.00	269	7.00	94	5.00	84
7.00	351	5.00	342	7.00	351	5.00	330
7.00	330	5.00	173	7.00	269	5.00	424
7.00	288	5.00	147	7.00	234	5.00	147
7.00	308	5.00	374	7.00	234	5.00	114
7.00	567	5.00	351	7.00	173	5.00	160
7.00	704	5.00	234	7.00	124	5.00	124
7.00	202	5.00	330	7.00	103	5.00	99
7.00	202	5.00	234	7.00	84	5.00	76
7.00	351	5.00	600	7.00	84	5.00	67
7.00	308	5.00	374	7.00	103	5.00	124
7.00	269	5.00	234	7.00	103	5.00	67
7.00	234	5.00	269	7.00	39	5.00	114
7.00	351	5.00	254	7.00	28	5.00	103
7.00	269	5.00	506	7.00	234	5.00	252
7.00	506	5.00	398	7.00	218	5.00	173
7.00	780	5.00	1,660	7.00	124	5.00	202
7.00	2,480	5.00	1,990	7.00	124	5.00	124
7.00	1,360	5.00	1,270	7.00	114	5.00	103
7.00	1,320	5.00	1,100	7.00	46	5.00	76
7.00	536	5.00	567	7.00	84	5.00	76
7.00	580	5.00	860	7.00	202	5.00	52
7.00	3,340	5.00	1,880	7.00	60	5.00	136
7.00	1,660	5.00	1,410	7.00	84	5.00	136
7.00	1,180	5.00	1,140	....	....	....	....
July.				August.			
7.00	136	5.00	60	7.00	398	5.00	424
7.00	124	5.00	28	7.00	389	5.00	398
7.00	60	5.00	39	7.00	308	5.00	506
7.00	46	5.00	28	7.00	424	5.00	398
7.00	34	5.00	28	7.00	234	5.00	567
7.00	52	5.00	46	7.00	536	5.00	633
7.00	39	5.00	28	7.00	567	5.00	567
7.00	269	5.00	103	7.00	308	5.00	269
7.00	136	5.00	103	7.00	188	5.00	234
7.00	103	5.00	124	7.00	567	5.00	567
7.00	103	5.00	76	7.00	668	5.00	704
7.00	173	5.00	234	7.00	668	5.00	780
7.00	52	5.00	234	7.00	742	5.00	567
7.00	234	5.00	398	7.00	351	5.00	374
7.00	506	5.00	398	7.00	567	5.00	374
7.00	234	5.00	39	7.00	234	5.00	76
7.00	52	5.00	84	7.00	67	5.00	64
7.00	52	5.00	67	7.00	76	5.00	398
7.00	94	5.00	67	7.00	136	5.00	76
7.00	52	5.00	52	7.00	351	5.00	269
7.00	395	5.00	234	7.00	269	5.00	67
7.00	633	5.00	536	7.00	67	5.00	39
7.00	308	5.00	114	7.00	67	5.00	39
7.00	173	5.00	173	7.00	52	5.00	28
7.00	160	5.00	173	7.00	67	5.00	60
7.00	269	5.00	234	7.00	67	5.00	147
7.00	152	5.00	160	7.00	114	5.00	34
7.00	234	5.00	288	7.00	28	5.00	52
7.00	398	5.00	269	7.00	60	5.00	67
7.00	633	5.00	450	7.00	34	5.00	28
7.00	398	5.00	424	7.00	28	5.00	52

Discharge, in second-feet, of Deerfield River at Hoosac Tunnel, Mass., for 1909–1913—Continued.

Day.	September.				October.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1913.								
1	7.00	52	5.00	46	7.00	288	5.00	202
2	7.00	88	5.00	136	7.00	234	5.00	147
3	7.00	124	5.00	67	7.00	218	5.00	308
4	7.00	34	5.00	39	7.00	160	5.00	173
5	7.00	28	5.00	39	7.00	147	5.00	120
6	7.00	124	5.00	67	7.00	94	5.00	103
7	7.00	76	5.00	34	7.00	103	5.00	60
8	7.00	64	5.00	114	7.00	76	5.00	103
9	7.00	67	5.00	67	7.00	49	5.00	103
10	7.00	94	5.00	136	7.00	114	5.00	124
11	7.00	94	5.00	103	7.00	124	5.00	103
12	7.00	52	5.00	39	7.00	67	5.00	76
13	7.00	34	5.00	28	7.00	300	5.00	269
14	7.00	28	5.00	34	7.00	234	5.00	136
15	7.00	46	5.00	39	7.00	114	5.00	103
16	7.00	31	5.00	28	7.00	120	5.00	103
17	7.00	39	5.00	67	7.00	142	5.00	114
18	7.00	39	5.00	34	7.00	94	5.00	84
19	7.00	147	5.00	114	7.00	67	5.00	67
20	7.00	67	5.00	39	7.00	173	5.00	1,460
21	7.00	28	5.00	234	7.00	1,270	5.00	860
22	7.00	288	5.00	1,770	7.00	450	5.00	450
23	7.00	1,360	5.00	780	7.00	269	5.00	234
24	7.00	780	5.00	308	7.00	103	5.00	147
25	7.00	288	5.00	160	7.00	147	5.00	202
26	7.00	234	5.00	147	7.00	1,660	5.00	3,340
27	7.00	114	5.00	124	7.00	2,750	5.00	1,180
28	7.00	99	5.00	67	7.00	940	5.00	780
29	7.00	60	5.00	52	7.00	742	5.00	940
30	7.00	46	5.00	49	7.00	1,180	5.00	780
31	......	......	......	......	7.00	351	5.00	330
	November.				December.			
1	7.00	308	5.00	308	......	......	......	......
2	7.00	160	5.00	124	......	......	......	......
3	7.00	124	5.00	196	......	......	......	......
4	7.00	330	5.00	308	......	......	......	......
5	7.00	351	5.00	398	......	......	......	......
6	7.00	351	5.00	308	......	......	......	......
7	7.00	288	5.00	202	......	......	......	......
8	7.00	218	5.00	202	......	......	......	......
9	7.00	780	4.00	5,930	......	......	......	......
10	7.00	5,930	5.00	3,340	......	......	......	......
11	7.00	1,770	5.00	1,360	......	......	......	......
12	7.00	940	5.00	860	......	......	......	......
13	7.00	704	5.00	450	......	......	......	......
14	7.00	555	5.00	780	......	......	......	......
15	7.00	668	5.00	440	......	......	......	......
16	7.00	478	5.00	398	......	......	......	......
17	7.00	398	5.00	308	......	......	......	......
18	7.00	424	5.00	398	......	......	......	......
19	7.00	351	5.00	308	......	......	......	......
20	7.00	780	5.00	704	......	......	......	......
21	7.00	1,020	5.00	780	......	......	......	......
22	7.00	633	5.00	633	......	......	......	......
23	7.00	567	5.00	536	......	......	......	......
24	7.00	450	4.30	398	......	......	......	......
25	7.00	330	4.30	440	......	......	......	......
26	7.00	330	4.30	351	......	......	......	......
27	7.00	288	4.30	234	......	......	......	......
28	7.00	269	4.30	234	......	......	......	......
29	7.00	269	4.30	288	......	......	......	......
30	7.30	308	4.30	288	......	......	......	......
31	......	......	......	......	......	......	......	......

NOTE.—Relation of gage height to discharge affected by ice during January, February, and March, 1911, and Jan. 6 to about Mar. 13, 1912. Discharge determined from a fairly well-defined rating curve.

Discharge determined from a fairly well defined rating curve; mean daily discharge not computed because of the unknown range of diurnal fluctuation. Figures for 1909 and 1910 are somewhat uncertain on account of apparent unreliability of observer.

. AT CHARLEMONT, MASS.

of Charlemont.

to September 30, 1915.
ank, referred to gage datum by a hook gage
taff gage used for auxiliary readings. (See

n cable or by wading.
coarse gravel and bowlders; fairly uniform
ent.
stage recorded 1913–1915: 15.7 feet, July 8,
000 second-feet. Minimum stage recorded:
ber 3, 1914; discharge, 23 second-feet.
cted by ice during winter months.
onths largely regulated by a storage reservoir
ants above station cause diurnal fluctuation.
ed as shown by figure 6. Records highly

iver at Charlemont, Mass., during 1913–1915.

s- ge.	Date.	Made by—	Gage height.	Discharge.
-ft.	1914.		*Feet.*	*Sec.-ft.*
188	June 9	R. S. Barnes............	2.01	211
138	Nov. 3	C. H. Pierce............	1.36	24.8
105	25	R. S. Barnes............	a 2.08	129
77	Dec. 23	.....do.................	a 2.28	92
414	1915.			
363	Jan. 14	C. H. Pierce............	a 2.38	380
480	18	R. S. Barnes............	a 2.19	288
230	Feb. 14	.....do.................	a 4.44	627
827	23	.....do.................	a 2.64	549
229	May 28	C. H. Pierce............	2.00	240
207	June 19	.....do.................	1.97	217
246	July 17	Hardin Thweatt	2.14	285
709	Aug. 17	.....do.................	2.12	258
398	24	.....do.................	3.38	1,230
,000	24	.....do.................	3.23	1,120
,950	24	.....do.................	3.11	1,010
,250	Oct. 1	.....do.................	2.62	580
,660				

elation affected by ice.

rfield River at Charlemont, Mass., for the years
ept. 30, 1913–1915.

pt.	Day.	June.	July.	Aug.	Sept.
	1913.				
49	16...............	....	255	115	47
76	17...............	....	57	53	55
97	18...............	....	72	135	51
49	19...............	72	74	288	100
79	20...............	192	70	147	79
112	21...............	255	235	94	59
124	22...............	245	215	49	700
59	23...............	153	188	62	1,530
97	24...............	128	188	76	521
45	25...............	132	225	38	260
87	26...............	90	215	47	175
66	27...............	106	166	97	128
43	28...............	132	205	43	87
43	29...............	81	422	68	85
38	30...............	100	364	103	76
	31...............	....	352	51	....

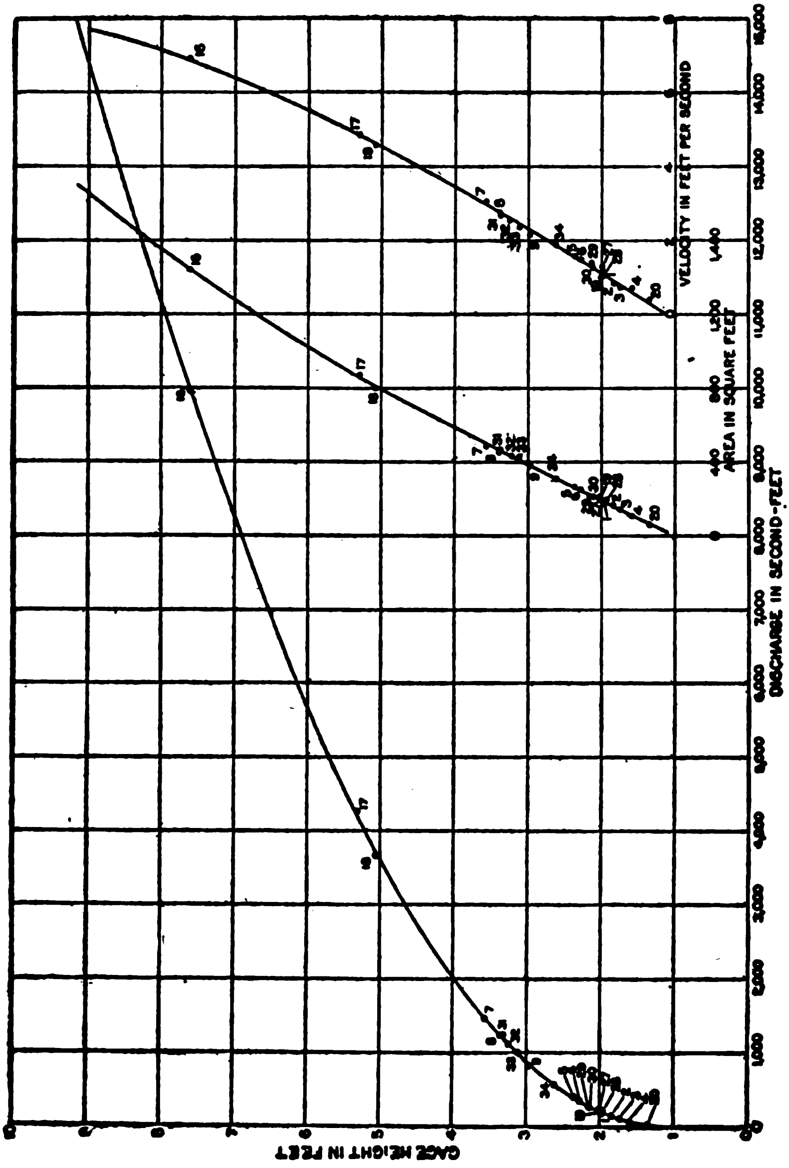


FIGURE 6.—Rating curve for Deerfield River at Charlemont, Mass.

eerfield River at Charlemont, Mass., for the years
30, 1913-1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
790	222	2,400	2,630	154	245	318	369
630	3,070	6,780	2,180	196	162	406	240
490	3,070	3,480	2,180	147	257	717	106
490	1,740	2,040	2,250	210	304	688	158
490	1,110	1,530	2,870	753	194	565	403
455	1,010	1,260	3,760	528	995	677	335
420	790	1,250	2,400	334	740	486	149
326	630	2,250	1,650	188	701	281	413
245	525	8,790	1,420	201	516	508	451
245	388	3,480	1,150	220	521	687	399
222	326	2,630	960	154	514	781	362
158	271	3,950	854	143	422	884	362
93	245	3,390	3,040	135	179	633	279
158	200	2,630	2,110	68	157	378	216
179	200	3,040	1,360	429	112	514	362
122	122	2,550	1,030	448	426	648	248
388	158	2,110	775	487	439	753	207
297	1,220	3,210	708	266	295	648	79
245	1,010	8,520	619	121	266	612	61
245	915	15,700	570	76	582	715	48
297	630	7,980	521	196	654	924	30
245	490	3,760	494	422	728	517	32
200	420	3,760	442	528	711	299	33
179	355	2,870	370	528	477	466	33
222	200	2,710	225	383	276	633	40
158	870	3,040	310	299	397	610	58
179	4,150	3,950	358	205	738	634	69
179	9,340	4,660	277	132	746	357	39
....	4,150	4,250	240	158	762	353	58
....	2,400	5,210	210	266	758	909	73
....	2,040	....	166	....	498	584	....
400	1,060	392	985	123	1,770	389	571
715	873	413	850	209	1,860	738	326
570	688	412	802	125	1,930	878	465
585	601	383	753	245	1,440	7,020	453
400	626	416	651	243	1,160	6,320	230
465	632	465	579	213	1,230	2,330	233
790	592	649	474	232	758	1,910	360
870	560	885	479	256	11,400	1,280	578
605	505	1,630	444	271	12,200	962	498
400	500	2,440	472	340	2,710	825	493
340	497	9,350	366	348	1,340	587	303
570	428	8,270	305	278	929	503	140
640	402	3,600	266	194	678	480	337
960	389	2,090	825	281	515	425	1,410
435	426	1,780	290	320	460	370	802
2,870	360	1,700	239	359	237	423	463
1,420	424	1,670	203	237	293	400	511
870	362	1,520	465	250	380	392	371
750	324	1,390	370	185	294	283	252
605	335	1,360	272	124	565	369	302
570	361	1,110	267	99	551	283	1,220
535	331	844	322	240	698	733	1,580
640	364	717	318	108	580	2,620	662
,050	457	596	186	104	500	1,140	626
,100	619	486	328	152	327	1,250	383
,440	871	537	138	136	422	950	330
,250	612	459	263	145	1,770	641	727
,360	500	426	282	262	1,170	522	638
......	509	538	243	362	776	349	503
......	380	695	199	265	593	618	461
......	365	....	152	....	393	758	....

ined rating curve (see fig. 6) by averaging the discharge
periods when automatic gage was not working properly.
. 29, 1913, to Mar. 26, 1914; Nov. 19, 1914, to Jan. 18, 1915;
nated by hydrograph method of determining backwater

Monthly discharge of Deerfield River at Charlemont, Mass., for the years ending Sept. 30 1913–1915.

[Drainage area, 362 square miles.]

Month.	Observed discharge (second-feet).			Gain or loss in storage at Somerset, Vt. (millions of cubic feet).	Discharge without storage (second-feet).		Run-off (depth in inches on drainage area).	Accuracy
	Maximum.	Minimum.	Mean.		Mean.	Per square mile.		
1913.								
June 19–30	255	81	140	....	....	....	....	
July	422	47	175	−196	103	0.285	0.33	A.
August	685	38	219	−352	79.5	.220	.25	A.
September	1,530	38	167	+13.5	172	.475	.53	A.
1913–14.								
October	3,390	70	540	+148	595	1.64	1.89	A.
November	11,000	299	1,170	+361	1,310	3.62	4.04	A.
December	2,960	297	616	+107	657	1.81	2.09	A.
January	870	82	363	+ 61.4	387	1.07	1.23	B.
February	790	93	298	+ 29.6	311	.859	.89	B.
March	9,340	122	1,360	+181	1,430	3.95	4.55	B.
April	15,700	1,250	4,120	+819	4,430	12.2	13.61	A.
May	3,760	166	1,230	+445	1,390	3.84	4.43	A.
June	753	68	279	−245	182	.503	.56	A.
July	995	112	477	−631	250	.691	.80	A.
August	924	281	587	−909	244	.674	.78	A.
September	451	30	190	−339	65	.180	.20	A.
The year	15,700	30	935	+ 38.3	936	2.59	35.07	
1914–15.								
October	257	29	90.8	+ 31.1	102	.282	.32	A.
November	889	41	177	+ 84.8	210	.580	.65	B.
December	304	43	133	+ 70.5	159	.439	.51	B.
January	5,210	70	761	+254	856	2.36	2.72	B.
February	12,100	340	1,400	+285	1,520	4.20	4.37	D.
March	1,060	324	515	+ 72.7	542	1.50	1.73	A.
April	9,350	383	1,570	+439	1,740	4.81	5.37	A.
May	985	138	396	+147	451	1.25	1.44	A.
June	362	99	224	−253	126	.348	.39	A.
July	12,200	237	1,610	+239	1,700	4.70	5.42	A.
August	7,020	283	1,190	+225	1,270	3.51	4.05	A.
September	1,580	140	541	−206	462	1.28	1.43	A.
The year	12,200	29	712	+1,390	756	2.09	28.40	

NOTE.—Data in regard to amount of water stored in Somerset reservoir were furnished by the New England Power Co. through J. B. Mahoney, superintendent of power.

Days of deficiency in discharge of Deerfield River at Charlemont, Mass., during the years ending Sept. 30, 1913–1915.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.			Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.		
		1912–13[a]	1913–14	1914–15			1912–13[a]	1913–14	1914–15
25	2.8	....	....	....	2,000	227	104	317	347
50	5.7	12	7	13	2,500	284	....	328	351
100	11.4	46	18	59	3,000	341	....	336	354
200	22.7	72	64	99	3,500	398	....	347	355
300	34.1	88	132	141	4,000	455	....	352	356
400	45.5	94	171	192	5,000	568	....	356	356
500	56.8	98	205	228	6,000	682	....	357	358
600	68.2	100	230	261	8,000	909	....	360	360
800	90.9	103	281	295	10,000	1,140	....	363	362
1,000	114	103	297	314	16,000	2,270	....	365	365
1,500	170	103	314	336					

[a] June 19 to Sept. 30.

NOTE.—The above table gives the theoretical horsepower per foot fall that may be developed at different rates of discharge, and shows the number of days on which the discharge and corresponding horsepower were respectively less than the amounts given in the columns for discharge and horsepower. In using this table, allowance should be made for the various losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

SHELBURNE FALLS, MASS.

eld Electric Light & Power Co. (Pl. VI), 1
ne 1, 1907, to December 31, 1913. At power
wer Co., from January 1, 1914, to September

first location. 500 square miles at second

eptember 30, 1915.

ne plant of the Greenfield Electric Light &
on, and is similar to one that has been rated.
3 feet in the fall of 1908. Ratings of one of
e by engineers of the Geological Survey for
e ratings of the wheels.

r is computed from records of gate openings,
ne dam, in the fore bay, in the tailrace, and
ical output is measured twice a day.

24-hour discharge computed 1907–1915:
. Minimum 24-hour discharge, practically
as held back by dams.

with which the readings are made in winter
lered good.

I. K. Barrows, Boston, Mass., and by the

l River at Shelburne Falls, Mass., for the years
. 30, 1907–1915.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
......	......	......	......	253	......	174	86
......	......	......	......	214	......	206	63
......	......	......	......	251	......	165	118
......	......	......	......	246	......	216	210
......	......	......	......	246	......	209	1,190
......	......	......	......	252	......	199	620
......	......	......	......	256	......	202	417
......	......	......	......	255	......	181	235
......	......	......	......	222	......	193	220
......	......	......	......	258	......	138	228
......	......	......	......	251	......	60	231
......	......	......	......	249	......	104	421
......	......	......	......	247	......	67	244
......	......	......	......	253	......	92	258
......	......	......	......	254	......	104	220
......	......	......	......	225	......	33	156
......	......	......	......	254	......	71	312
......	......	......	......	256	......	108	173
......	......	......	......	247	......	108	147
......	......	......	......	241	......	77	139
......	......	......	......	204	......	99	133
......	......	......	......	227	432	129	134
......	......	......	......	199	255	92	305
......	......	......	......	189	258	99	1,980
......	......	......	......	240	554	106	1,370
......	......	......	......	433	1,370	87	771
......	......	......	......	408	817	84	765
......	......	......	......	320	368	105	404
......	......	......	......	251	233	113	4,100
......	......	......	......	834	231	53	1,370
......	......	......	......	......	162	114	......

Daily discharge, in second-feet, of Deerfield River at Shelburne Falls, Mass, for the years ending Sept. 30, 1907–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1907–8.												
1	866	2,380	250	1,080	599	742	2,740	7,190	3,630	170	200	99
2	648	2,390	287	1,080	400	718	2,350	2,500	2,500	159	177	138
3	470	7,680	295	776	237	944	1,810	2,090	1,840	137	92	139
4	800	3,580	267	599	215	958	1,290	1,650	1,230	146	132	102
5	1,370	2,380	192	490	344	968	1,290	1,430	1,100	136	113	118
6	1,060	1,980	247	318	730	646	1,350	848	1,080	195	337	143
7	553	16,300	351	381	383	954	2,440	878	554	284	328	135
8	1,090	3,540	357	1,090	485	826	2,730	8,910	295	248	266	130
9	1,360	1,970	452	723	718	729	6,590	5,220	289	157	372	120
10	978	1,630	2,350	625	599	730	3,340	3,110	259	135	558	110
11	867	1,220	2,320	624	599	1,240	4,360	2,350	257	130	272	100
12	872	857	1,870	793	774	969	2,910	1,590	259	98	275	90
13	730	644	955	1,380	581	1,250	2,170	1,830	288	98	332	80
14	675	647	967	1,340	583	1,660	1,490	2,140	235	106	273	70
15	406	557	833	1,360	1,470	1,850	1,440	3,410	187	139	268	67
16	396	477	728	908	7,020	2,260	4,280	2,500	983	94	179	79
17	331	341	633	1,020	2,650	1,250	1,820	1,960	576	101	150	65
18	241	405	632	719	1,560	1,250	1,810	1,670	419	79	1,110	88
19	264	397	544	815	974	1,120	4,730	1,520	258	279	419	58
20	252	408	552	433	1,100	1,250	2,920	1,670	269	213	298	40
21	296	411	535	443	848	1,250	1,960	1,520	179	242	258	77
22	279	397	432	628	994	1,550	1,230	2,670	182	221	252	55
23	283	436	2,370	731	844	1,500	1,490	6,090	182	495	239	......
24	284	368	1,680	537	485	1,430	2,350	3,400	178	373	248	......
25	288	435	1,920	383	218	4,410	2,160	2,660	409	573	206	......
26	278	434	1,360	383	293	1,910	3,080	1,820	221	3,160	235	......
27	237	483	1,080	914	1,010	7,730	2,730	1,520	174	1,850	265	......
28	3,360	408	1,080	597	769	5,760	3,140	1,520	230	640	208	......
29	10,100	398	1,070	830	506	10,600	2,740	998	153	326	183	......
30	5,010	342	1,080	479	......	6,580	1,820	1,100	186	235	144	......
31	3,600	......	1,670	184	......	3,550	......	6,080	......	250	111	......
1908–9.												
1	......	158	196	150	150	933	771	2,000	559	177	99	121
2	......	189	204	228	286	903	1,700	3,140	442	172	77	101
3	......	173	90	171	308	742	2,400	2,200	475	245	57	88
4	......	127	93	350	260	687	1,680	2,780	467	270	120	64
5	......	151	102	371	386	751	2,460	2,580	466	253	113	114
6	......	180	89	6,400	685	608	3,340	1,990	1,670	234	273	66
7	......	155	169	1,700	1,680	665	9,040	3,850	863	205	264	127
8	......	142	757	909	1,120	596	8,140	2,210	648	151	219	138
9	......	150	528	711	542	594	4,610	1,650	511	152	112	122
10	......	185	303	744	526	640	2,830	1,380	555	136	115	115
11	......	167	343	619	765	1,280	1,860	1,240	1,100	146	101	219
12	......	206	297	550	528	1,280	1,540	1,100	755	85	76	288
13	......	282	320	342	479	898	2,610	857	522	182	113	183
14	......	257	232	229	577	885	18,900	743	535	85	90	153
15	......	221	263	492	463	667	21,300	646	550	119	82	140
16	......	161	378	407	742	630	8,460	596	468	118	212	130
17	......	193	179	279	404	586	7,290	847	408	133	1,140	106
18	......	170	219	365	473	535	6,660	1,230	3,830	150	1,580	130
19	......	121	193	237	410	580	5,850	970	1,370	136	606	74
20	......	177	218	261	4,830	555	9,350	852	830	131	415	90
21	......	239	337	297	3,390	564	4,600	743	643	141	361	47
22	55	212	271	381	2,140	541	5,610	633	417	136	246	99
23	50	179	155	553	1,370	539	3,620	815	534	128	181	92
24	60	208	132	735	2,240	633	2,620	688	473	127	190	222
25	76	247	149	1,780	4,290	1,230	2,190	638	341	165	167	219
26	129	268	163	1,000	2,460	2,980	2,250	624	345	152	126	212
27	390	348	295	619	1,740	1,530	1,910	551	241	134	104	179
28	471	352	178	593	1,280	1,220	3,470	1,100	212	138	136	3,780
29	405	373	147	417	......	1,390	2,430	1,360	242	118	112	1,430
30	411	205	152	464	......	1,250	2,250	1,080	194	111	119	578
31	271	......	156	287	......	1,120	......	845	......	91	110	......

River at Shelburne Falls, Mass., for the years 07–1915—Continued.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
36	11,200	4,880	1,070	1,590	222	136	56
00	6,360	4,120	989	1,180	189	104	71
77	4,250	2,970	954	925	186	135	14
99	2,990	2,630	1,070	710	172	135	90
96	2,350	2,510	1,010	660	171	141	229
88	2,580	2,870	887	3,570	190	136	710
04	4,950	2,940	756	2,240	169	104	707
18	3,300	2,070	684	1,540	193	114	804
32	2,290	1,430	625	1,170	125	96	243
90	1,630	1,140	744	1,170	113	101	184
83	1,430	1,010	724	2,520	94	196	16
43	1,300	1,030	657	2,590	152	260	120
09	1,410	919	552	2,210	131	192	103
12	1,580	821	526	1,440	102	113	174
85	1,180	790	724	1,160	105	140	155
18	1,060	782	618	961	131	104	111
725	1,070	749	512	1,170	81	136	92
706	879	850	604	1,290	100	106	56
620	869	1,930	942	1,090	278	62	84
617	1,660	1,320	1,010	818	235	75	78
825	3,080	1,050	799	666	262	82	143
050	2,660	858	942	491	121	108	110
070	3,110	944	709	447	141	53	73
970	3,560	710	618	508	88	97	115
906	9,460	653	786	247	121	120	85
815	8,220	4,750	1,710	248	145	82	149
150	4,580	4,170	1,390	281	188	50	117
830	4,080	2,020	865	278	397	39	144
....	6,160	1,360	655	277	157	55	160
....	7,480	1,220	565	275	152	63	193
....	5,840	....	1,700	....	145	65	....
297	420	1,310	3,600	373	218	200	397
517	331	1,110	5,920	476	200	158	300
205	264	959	2,850	410	196	160	185
244	251	961	1,890	324	167	129	269
354	217	1,060	1,280	301	184	158	280
396	219	5,160	1,090	363	153	43	652
292	214	8,700	965	2,520	153	123	1,040
213	213	5,020	711	1,730	105	92	980
219	243	4,130	752	826	124	125	2,530
336	223	2,240	710	683	118	158	2,090
271	183	2,060	607	720	135	103	910
215	237	1,990	636	1,200	118	70	775
246	235	2,840	901	3,480	91	59	459
262	444	4,600	701	1,830	101	75	351
226	614	6,730	521	1,300	41	103	328
220	402	4,540	534	896	0	179	911
219	317	2,900	456	807	95	247	657
330	314	2,120	354	631	133	122	434
327	323	2,290	927	530	149	132	365
281	298	2,260	805	440	112	150	313
266	368	2,050	587	374	119	181	289
234	354	2,460	424	353	80	131	640
224	677	2,130	446	322	62	143	607
201	498	1,990	383	294	122	81	452
213	501	3,330	447	257	172	142	559
257	782	4,090	414	375	315	204	351
768	5,030	4,470	438	437	216	251	354
605	6,200	4,940	357	411	145	258	420
....	3,510	4,710	302	308	242	1,730	648
....	4,120	3,760	229	260	276	903	1,490
....	1,360	....	314	....	253	639	....

Daily discharge, in second-feet, of Deerfield River at Shelburne Falls, Mass, for the years ending Sept. 30, 1907–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	845	1,320	1,190	656	346	307	6,060	1,640	2,450	120	126	118
2	2,390	1,040	903	331	218	299	5,750	1,290	1,590	147	142	145
3	1,320	772	712	297	317	305	3,960	1,280	5,820	153	151	291
4	2,080	760	747	414	332	299	2,700	978	2,620	110	183	570
5	2,430	622	509	200	323	275	3,420	923	1,980	93	188	424
6	1,340	651	575	185	336	258	8,120	1,280	1,830	81	142	276
7	1,320	1,500	502	251	306	268	11,100	2,030	2,460	60	118	247
8	1,270	1,500	515	368	348	289	8,120	1,470	1,580	199	122	200
9	1,470	1,050	506	381	272	341	3,960	1,280	1,320	164	110	154
10	1,170	902	586	411	296	369	2,940	1,470	717	142	101	188
11	912	1,040	583	293	271	285	2,460	1,270	643	110	431	146
12	796	940	797	299	276	300	2,250	909	342	92	561	122
13	645	1,510	945	252	272	2,950	2,460	987	344	107	313	113
14	534	1,180	823	333	262	1,640	3,630	1,650	338	73	200	116
15	607	1,180	951	260	266	2,440	3,410	1,270	322	124	137	51
16	554	1,050	1,220	267	264	5,600	7,760	1,840	403	219	148	351
17	552	664	2,050	265	248	3,650	6,050	5,110	385	146	107	650
18	6,710	2,470	1,380	273	279	3,700	5,430	2,670	343	147	143	374
19	11,100	2,220	945	297	264	4,540	4,760	1,580	334	438	425	274
20	4,560	1,500	701	669	294	4,840	2,910	1,290	334	364	462	278
21	3,550	1,180	591	649	300	3,160	2,390	1,460	298	230	257	292
22	4,750	1,050	749	633	372	2,260	2,680	2,250	218	238	165	280
23	4,550	779	4,280	476	366	1,280	3,950	1,640	215	252	245	266
24	2,660	927	2,840	455	357	1,240	2,930	1,290	238	191	417	276
25	1,860	913	1,820	424	340	1,130	2,250	1,440	251	165	317	282
26	1,320	746	1,360	420	379	840	1,840	1,075	198	118	340	205
27	1,170	773	1,550	266	371	987	1,630	849	212	125	498	202
28	1,030	677	1,380	251	353	847	1,980	847	181	134	360	149
29	947	3,120	794	341	340	3,970	1,650	993	161	86	266	148
30	820	1,460	587	368	....	4,840	1,650	6,670	121	118	260	240
31	906	....	912	368	....	3,640	....	4,530	....	100	178	....
1912–13.												
1	388	1,190	659	1,890	2,710	1,180	3,470	889	1,120	122	286	58
2	311	2,060	967	1,360	1,490	799	1,870	863	1,050	120	273	96
3	327	1,660	5,250	2,490	1,450	641	1,500	612	930	142	101	96
4	274	1,340	2,560	3,360	1,440	763	1,480	451	785	67	244	97
5	238	1,180	1,780	2,000	1,200	570	1,870	658	345	56	286	123
6	213	1,060	3,680	1,530	1,320	495	1,800	545	360	61	393	154
7	142	1,340	3,220	3,380	1,030	463	1,500	389	315	113	492	58
8	212	4,320	2,100	4,290	1,210	339	1,330	467	256	240	582	135
9	182	2,670	1,580	2,890	1,240	395	1,330	357	444	114	215	117
10	142	2,000	1,430	2,110	1,040	1,500	1,030	369	349	145	303	160
11	270	1,490	1,260	1,550	557	1,340	2,300	253	284	171	565	159
12	474	1,500	930	4,150	498	1,020	4,600	345	254	148	700	110
13	308	1,510	839	2,750	381	1,330	3,130	335	280	142	462	150
14	592	3,820	986	1,730	471	5,470	2,980	352	194	327	348	100
15	396	3,110	421	1,440	397	7,110	2,070	311	117	270	331	114
16	281	2,020	651	1,370	376	4,810	1,680	326	250	242	174	70
17	267	1,820	1,000	3,390	689	2,080	1,500	344	258	128	28	82
18	223	1,680	865	5,730	413	1,330	1,330	305	206	100	104	58
19	225	1,340	1,450	4,800	357	1,170	1,130	380	180	69	316	57
20	212	1,190	1,780	2,700	329	2,980	963	403	240	121	184	149
21	295	1,340	1,150	3,820	465	3,720	1,020	355	244	230	100	0
22	290	1,350	1,060	2,920	879	4,890	1,030	390	224	261	127	892
23	4,350	1,180	858	2,110	1,020	1,790	889	1,710	227	220	108	1,600
24	13,900	1,140	472	2,710	789	3,220	755	2,700	212	228	42	733
25	6,760	1,510	365	1,920	600	4,280	756	1,620	171	198	124	188
26	4,540	1,350	525	1,450	469	12,100	749	1,190	164	176	78	302
27	2,420	1,190	635	1,530	480	19,200	661	903	144	185	98	123
28	2,060	1,140	619	923	1,230	7,460	755	1,510	162	232	55	74
29	1,690	470	657	1,060	....	3,480	1,870	3.570	112	294	165	181
30	1,510	620	986	1,073	....	2,020	1,490	2.030	150	410	124	139
31	1,360	....	3,460	1,071	....	2,740	....	1,370	....	277	157	....

River at Shelburne Falls, Mass., for the years 907–1915—Continued.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
85	412	2,850	4,440	157	323	307	530
68	6,020	11,000	3,660	223	248	239	299
93	4,320	5,980	2,920	327	118	645	145
54	3,120	3,690	2,900	422	147	808	109
88	1,980	2,940	3,790	567	213	618	481
57	1,150	2,210	4,020	916	871	632	211
93	1,260	2,090	2,980	306	1,010	638	244
66	683	3,940	2,300	305	702	283	334
40	874	11,200	1,980	236	640	339	494
342	703	5,630	1,800	237	592	746	490
393	674	4,620	1,400	230	527	665	337
371	547	6,600	1,430	215	389	915	375
305	552	5,950	4,210	173	437	949	208
324	569	4,240	2,930	81	179	406	306
308	592	4,990	2,160	352	167	367	305
332	538	4,360	1,670	549	346	375	283
476	859	3,670	1,510	595	457	795	191
394	1,250	3,750	1,100	360	350	764	182
339	995	10,900	842	224	308	770	82
327	892	14,500	713	98	523	691	a 70
298	688	12,000	616	22	570	1,060	59
265	680	6,670	742	590	757	1,010	40
322	721	4,400	592	584	734	263	a 40
278	682	4,020	441	530	664	450	a 40
255	618	3,950	450	557	276	607	41
248	1,140	4,700	206	329	223	568	25
283	6,160	6,340	393	176	638	659	a 55
431	15,100	5,960	455	61	706	418	85
.....	8,660	5,380	341	315	809	425	64
.....	5,330	7,010	190	265	880	a 619	53
.....	4,230	....	232	....	652	813	....
482	1,110	611	1,470	276	1,090	382	762
860	952	637	1,500	287	1,870	1,760	600
730	1,000	640	1,120	207	2,570	1,270	535
794	764	479	1,030	339	1,580	13,600	583
537	867	743	1,060	162	1,260	9,240	248
684	1,090	759	657	171	1,360	3,350	244
,150	948	1,010	759	300	868	2,780	621
,420	815	1,530	609	284	7,800	1,880	599
916	799	2,780	489	295	20,200	1,490	656
645	716	3,420	574	389	4,950	1,150	549
473	769	10,800	502	392	1,360	962	524
632	667	12,400	392	312	914	692	68
722	525	5,400	336	192	800	704	310
571	595	3,460	349	255	621	689	1,950
638	603	2,640	506	564	626	380	1,060
3,850	579	2,890	196	312	360	642	649
2,600	585	2,930	450	343	272	700	532
1,620	540	2,320	470	345	601	445	454
1,040	508	2,490	572	254	344	441	219
846	462	1,820	447	34	661	432	424
783	571	1,910	314	177	545	412	1,600
700	483	1,200	589	317	980	1,550	1,940
777	541	1,140	279	160	849	3,800	914
1,570	680	1,150	383	159	598	1,740	594
8,090	839	511	363	140	300	1,640	549
8,500	1,240	799	428	216	481	1,300	219
4,260	855	616	367	133	1,890	899	935
3,170	603	579	278	214	1,610	571	866
....	929	518	455	514	834	422	618
....	584	765	98	238	831	994	542
....	480	....	57	....	549	1,050	....

Interpolated.

Monthly discharge of Deerfield River at Shelburne Falls, Mass., for the years ending Sept 30, 1907–1915.

[Drainage area, 501 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1907.					
June	834	189	274	0.547	0.6
July 22–31	1,370	162	468	.934	.3
August	216	33	122	.244	.2
September	4,100	63	567	1.13	1.2
1907–8.					
October	10,100	237	1,230	2.46	2.8
November	16,300	341	1,800	3.59	4.0
December	2,370	192	947	1.89	2.1
January	1,380	184	731	1.46	1.6
February	7,020	215	965	1.93	2.0
March	10,600	646	2,210	4.41	5.0
April	6,590	1,230	2,550	5.09	5.6
May	8,910	848	2,700	5.39	6.2
June	3,630	153	620	1.24	1.3
July	3,160	79	370	.739	.8
August	1,110	92	274	.547	.6
September 1–22	143	40	95.6	.191	.1
1908–9.					
October 22–31	471	50	232	.463	.1
November	373	121	207	.413	.4
December	757	89	236	.471	.5
January	6,400	150	730	1.46	1.6
February	4,830	150	1,230	2.46	2.5
March	2,980	535	904	1.80	2.0
April	21,300	771	5,060	10.1	11.2
May	3,850	551	1,350	2.69	3.1
June	3,830	194	689	1.38	1.5
July	270	85	152	.303	.3
August	1,580	57	249	.497	.5
September	3,780	47	313	.625	.7
1909–10.					
October	698	145	314	.627	.7
November	526	171	284	.567	.6
December	474	87	242	.483	.5
January	16,900	151	1,500	2.99	3.4
February	9,830	204	970	1.94	2.0
March	11,200	869	3,630	7.25	8.3
April	4,880	653	1,850	3.69	4.1
May	1,710	512	851	1.70	1.9
June	3,570	247	1,120	2.24	2.5
July	397	81	163	.33	.3
August	260	39	110	.22	.2
September	710	14	163	.33	.3
The year	16,900	14	933	1.86	25.3
1910–11.					
October	252	62	132	.26	.3
November	957	125	307	.61	.6
December	594	33	169	.34	.3
January	5,450	177	997	1.99	2.2
February	768	201	301	.601	.6
March	6,200	183	947	1.89	2.1
April	8,700	959	3,230	6.45	7.2
May	5,920	229	986	1.97	2.2
June	3,480	257	774	1.55	1.7
July	315	0	148	.295	.3
August	1,730	43	234	.467	.5
September	2,530	185	668	1.33	1.4
The year	8,700	0	741	1.48	20.6

burne Falls, Mass., for the years ending Sept.
5—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).
ximum.	Minimum.	Mean.	Per square mile.	
11,100	534	2,130	4.25	4.90
3,120	622	1,180	2.36	2.63
4,280	502	1,100	2.20	2.54
669	185	366	.73	.84
379	218	309	.62	.67
5,600	268	1,840	3.68	4.24
11,100	1,630	4,010	8.00	8.93
6,670	847	1,780	3.55	4.09
5,820	121	940	1.88	2.10
438	60	156	.31	.36
561	101	245	.49	.56
650	51	248	.50	.55
11,100	51	1,190	2.38	32.41
13,900	142	1,450	2.89	3.33
4,320	470	1,650	3.30	3.68
5,250	365	1,430	2.84	3.27
5,730	923	2,430	4.86	5.60
2,710	329	876	1.75	1.82
19,200	339	3,240	6.48	7.47
4,600	661	1,630	3.25	3.63
3,570	263	849	1.70	1.96
1,120	112	334	.67	.75
410	56	181	.36	.42
700	28	244	.49	.56
1,600	0	212	.42	.47
19,200	0	1,210	2.42	32.96
4,580	17	674	1.35	1.56
6,030	350	1,070	2.14	2.39
1,770	150	679	1.35	1.56
2,710	125	486	.972	1.12
885	248	416	.832	.87
15,100	412	2,320	4.64	5.35
14,500	2,090	5,850	11.7	13.05
4,440	190	1,720	3.44	3.97
916	22	333	.666	.74
1,010	118	499	.998	1.15
1,060	239	608	1.22	1.41
530	26	206	.412	.46
15,100	17	1,240	2.48	33.63
361	0	108	.216	.25
1,200	21	253	.506	.56
484	7	173	.346	.40
6,630	11	987	1.97	2.27
8,500	473	1,750	3.30	3.44
1,240	462	732	1.46	1.68
12,400	479	2,300	4.60	5.13
1,500	57	552	1.10	1.27
564	34	266	.532	.59
20,200	272	1,920	3.84	4.43
13,600	380	1,850	3.70	4.27
1,950	68	679	1.36	1.52
20,200	0	959	1.92	25.81

Days of deficiency in discharge of Deerfield River at Shelburne Falls, Mass., during th years ending Sept. 30, 1908–1915.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.							
		[a] 1907–8	[b] 1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15
25	2.8	....	....	2	1	....	1	2	
50	5.7	1	1	3	4	....	3	7	1
100	11.4	17	24	27	25	7	20	19	4
150	17.0	39	71	67	79	41	52	27	6
200	22.7	57	111	104	110	57	72	43	8
250	28.4	76	138	139	150	75	93	67	10
300	34.1	110	157	171	184	119	113	88	11
400	45.5	132	176	196	226	162	150	143	14
500	56.8	156	197	209	251	176	168	175	17
600	68.2	174	224	223	265	190	175	205	21
700	79.5	185	242	239	280	202	187	235	24
800	90.9	200	254	255	290	215	197	256	26
900	102	213	263	266	295	222	205	272	27
1,000	114	227	267	278	307	240	213	276	28
1,200	136	244	275	302	312	254	240	289	30
1,400	159	262	288	308	317	276	262	299	31
1,600	182	276	292	317	320	289	285	304	32
2,000	227	299	303	323	327	303	303	310	33
2,500	284	314	315	331	337	320	318	315	33
3,000	341	326	321	341	343	330	330	323	34
3,500	398	334	325	345	346	334	340	323	34
4,000	455	339	329	347	349	343	346	331	35
5,000	568	343	333	355	357	352	356	344	35
6,000	682	346	335	357	362	357	359	351	35
7,000	795	350	337	359	364	361	360	357	357
8,000	909	354	338	360	364	362	362	358	35
9,000	1,020	355	340	361	365	364	362	359	360
10,000	1,140	355	342	363	....	364	362	359	361
15,000	1,700	357	342	364	....	366	364	364	364
20,000	2,270	358	343	365	....	....	365	365	364
25,000	2,840	....	344	....	....	....	....	....	365

[a] Period Oct. 1 to Sept. 22.

[b] Period Oct. 22 to Sept. 30.

NOTE.—The above table gives the theoretical horsepower per foot fall that may be developed at different rates of discharge, and shows the number of days on which the discharge and corresponding horsepowe were respectively less than the amounts given in the columns for discharge and horsepower. In using this table allowance should be made for the various losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

DEERFIELD RIVER NEAR DEERFIELD, MASS.

LOCATION.—At suspension highway bridge, one-fourth mile south of West Deerfield railroad station and about 2 miles from Deerfield.

DRAINAGE AREA.—550 square miles.

RECORDS AVAILABLE.—March 29, 1904, to December 15, 1905; also a discharge measurement made September 21, 1906.

GAGE.—Chain attached to bridge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rock, gravel, and sand; one channel at all stages; control practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded: 7.2 feet at 1.15 p. m., January 7, 1905; approximate discharge, 17,300 second-feet. Minimum stage recorded: 1.58 feet September 21, 1906; discharge, 85 second-feet.

WINTER FLOW.—Discharge relation affected by ice.

REGULATION.—Flow regulated by operation of several power plants above station.

ACCURACY.—On account of the unknown range of diurnal fluctuation the estimates of discharge, which are based on two gage readings a day, can be considered only approximate.

er near Deerfield, Mass., during 1904–1906.

.	Date.	Made by—	Gage height.	Discharge.
.	1905.		*Feet.*	*Sec.-ft.*
0	Apr. 4	T. W. Norcross..........	3.97	3,710
0	Aug. 16	.....do..................	3.29	1,680
0	16	.....do..................	3.56	2,290
0	16	.....do..................	3.69	2,520
0	17	.....do..................	3.68	2,380
0	17	.....do..................	3.51	2,000
3	17	.....do..................	3.42	1,840
5	31	.....do..................	3.12	1,310
0				
1	1906.			
1	Sept. 21	F. E. Pressey...........	1.58	85

ion affected by ice.

ield River near Deerfield, Mass., for 1904–5.

ay.	June.	July.	Aug.	Sept.	Oct.	Nov.
,170	760	620	280	220	1,760	490
,510	620	910	280	180	995	555
,330	690	555	325	280	690	370
,060	835	555	370	280	620	370
,680	910	490	280	280	490	370
,080	760	430	280	280	490	280
,970	1,170	430	250	220	430	370
,750	2,080	490	220	220	370	280
,260	11,200	430	280	280	370	220
,860	3,470	370	370	370	325	220
,080	2,080	370	760	490	760	220
,650	1,170	370	490	325	760	220
,450	910	370	430	250	690	220
,360	910	370	370	220	835	280
,080	760	325	490	9,120	760	325
3,060	760	325	370	2,430	620	280
3,330	620	325	280	1,260	555	220
3,060	620	430	370	995	490	220
5,340	620	370	370	835	430	280
,830	555	430	555	555	370	325
2,550	490	280	3,200	370	3,900	490
2,080	430	280	1,080	325	5,880	760
1,650	430	280	555	325	2,430	620
1,450	490	280	430	430	1,080	490
1,360	490	325	370	490	760	370
1,450	760	430	370	490	760	280
1,450	430	490	325	490	760	220
1,080	370	490	280	490	620	250
910	250	370	280	760	620	280
620	490	280	220	4,200	490	220
835	....	280	220	....	370	....

Daily discharge, in second-feet, of Deerfield River near Deerfield, Mass., for 1904-5—Continued.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.											
1	....	....	9,340	1,260	325	490	1,170	995	370	325	1,970
2	....	....	4,360	1,080	370	430	690	760	370	370	1,550
3	....	....	3,470	760	280	370	430	8,680	370	370	12,000
4	....	....	3,200	760	370	370	370	6,820	430	490	5,170
5	....	....	3,900	995	370	490	280	4,830	490	370	2,430
6	....	....	8,250	952	370	555	250	2,430	370	835	1,450
7	17,300	....	4,510	910	370	555	370	1,760	370	1,360	1,260
8	4,830	....	2,800	835	620	370	280	1,450	430	1,080	1,080
9	2,680	....	2,200	760	490	325	280	1,260	430	910	910
10	1,760	....	2,800	690	490	280	280	1,080	370	620	1,080
11	1,760	....	7,830	690	430	325	280	620	370	490	1,170
12	3,470	....	7,830	370	370	325	1,170	3,610	1,550	430	1,080
13	3,200	....	4,830	620	370	325	910	2,080	1,170	430	910
14	....	....	3,760	620	370	280	690	1,450	910	370	835
15	....	....	3,200	620	325	250	370	1,080	835	370	760
16	....	....	2,430	1,170	280	220	2,080	910	555	555	....
17	....	....	1,860	1,450	280	220	2,310	1,080	370	620	....
18	....	....	1,650	1,260	280	180	910	3,060	430	555	....
19	....	....	1,360	1,080	220	280	555	5,700	555	370	....
20	....	....	1,260	555	430	280	220	3,060	1,170	325	....
21	....	....	2,080	620	910	280	180	2,550	1,860	490	....
22	....	....	3,900	620	4,200	250	325	1,860	910	370	....
23	....	....	3,200	490	2,080	220	370	1,360	835	490	....
24	....	....	1,760	490	1,080	180	280	995	760	280	....
25	....	....	1,450	370	760	220	280	760	690	325	....
26	....	....	1,550	370	690	250	325	760	620	370	....
27	....	14,000	1,860	325	1,260	250	325	690	490	325	....
28	....	8,460	1,650	370	835	250	280	620	430	280	....
29	....	8,680	1,650	370	620	280	250	555	370	1,170	....
30	....	10,500	1,450	370	620	1,860	370	490	325	5,520	....
31	....	12,700	....	370	....	2,080	1,360	....	325	....	....

NOTE.—Discharge determined from a rating curve fairly well defined between 370 and 7,000 second-feet.

Monthly discharge of Deerfield River near Deerfield, Mass., for 1904-5.

[Drainage area, 550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1904.					
April	10,700	1,550	4,050	7.36	8.21
May	5,340	620	2,270	4.13	4.76
June	11,200	250	1,200	2.18	2.43
July	910	280	411	.747	.86
August	3,200	220	476	.865	1.00
September	9,120	180	915	1.66	1.85
October	5,880	325	983	1.79	2.06
November	760	220	336	.611	.68
1905.					
January 7-13	17,300	1,760	5,000	9.09	2.37
March 27-31	14,000	8,460	10,900	19.80	3.68
April	9,340	1,260	3,380	6.15	6.86
May	1,450	325	716	1.30	1.50
June	4,200	220	682	1.24	1.38
July	2,080	180	421	.765	.88
August	2,310	180	588	1.07	1.23
September	8,680	490	2,110	3.84	4.28
October	1,860	325	630	1.15	1.33
November	5,520	280	696	1.27	1.42
December 1-15	12,000	760	2,240	4.07	2.27

RIVER BASIN.

L FEATURES.

tributary of the Connecticut with
ed near Three Rivers, Mass., by the
g rivers, the third river, from which
ng the Swift, which is tributary to
the mouth of the Quaboag.

larger area and is therefore consid-
in stream, is formed at Barre Falls
The eastern or main branch rises in
rcester County, about a mile east of
flows southwesterly 10 miles to New
y and flows northwestward to Barre
ern branch is also southwesterly to
Barre Falls the general course of the
e Rivers, where it receives the Qua-
e Quaboag the Chicopee flows south
ee, where it enters the Connecticut.
of the Chicopee to the head of the
is 60 miles, and the drainage area
ided as follows:

	Square miles.
lusive of Swift River	221
	213
	210
vers	77

branches, but the river is formed
es, and the middle branch is consid-
stream. This branch rises in North
e, and flows southward. The east
Enfield, and the west branch comes
. The distance from North Pond to
he Ware is about 30 miles. The gag-
miles above the mouth of the river,
point comprises 186 square miles.

outherly of the three principal tribu-
m Quaboag Pond in the town of Brook-
f Quaboag Pond is East Brookfield
n the town of Rutland.[1] The general
westerly, and the distance from Qua-
23 miles. The gaging station at West
mouth, and the drainage area at that
At West Warren, 12 miles above the
44 square miles.

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e gazetteer, p. 332.

The country drained by the Chicopee is hilly, and the slope of the river averages 15 feet or more to the mile. Many lakes and ponds drain to the stream through its numerous tributaries, and the summer flow is well sustained.

The Chicopee is one of the most completely controlled streams in Massachusetts, as the natural pond area is large and is supplemented by artificial ponds formed at the numerous power plants. (See Pl. IX, *B*.) These ponds and reservoirs materially retard floods and equalize the flow throughout the year.

WARE RIVER NEAR WARE, MASS.

Location.—At the steel highway bridge about 2 miles above the village of Ware.

Drainage area.—162 square miles.

Records available.—Discharge measurements September 15, 1904, to March 8, 1911.

Gage.—Chain attached to the bridge.

Discharge measurements.—Made from the bridge or by wading.

Channel and control.—Channel is subject to growth of grass and weeds during the summer, and on account of this the control is not permanent. At high stages the control is at the dam of the Otis Co., 2½ miles below station.

Winter flow.—Stream seldom freezes at the gage, but the discharge relation is affected by backwater from ice farther downstream.

Regulation.—Flow regulated by the operation of mills above the station, the nearest one being at Gilbertville, a little over a mile distant.

Accuracy.—On account of the large diurnal fluctuation and the shifting control below the station, the gage-height record obtained at this station is not considered a true index to the discharge. This record and estimates of discharge are withheld from publication here, and figures for this station published in previous reports should be used with caution.

Discharge measurements of Ware River near Ware, Mass., during 1904–1911.

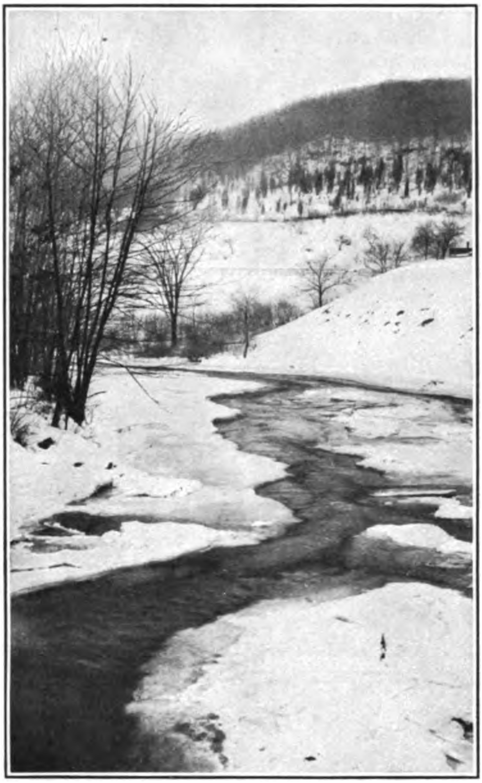
Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1904.		*Feet.*	*Sec.-ft.*	1907.		*Feet.*	*Sec.-ft.*
Sept. 15	H. K. Barrows	4.44	863	Apr. 26	Wood and Mention	3.43	489
20	T. W. Norcross	2.59	169	May 18	D. M. Wood	3.35	408
Oct. 5	do	2.63	166	Sept. 24	do	5.55	[b] 1,150
19	do	2.70	205				
29	do	2.80	193	1908.			
Nov. 14	do	2.46	133	Mar. 2	D. M. Wood	3.38	243
				Apr. 25	do	3.14	310
1905.				Sept. 26	Wood and French	2.56	96.9
Mar. 28	T. W. Norcross	6.92	2,550				
28	do	6.96	2,600	1909.			
Apr. 1	do	5.75	1,690	Jan. 2	D. M. Wood	[c] 2.83	160
7	do	5.06	1,240	July 14	do	2.47	115
13	do	4.00	758	Aug. 5	do	2.50	111
29	do	2.74	214	24	do	2.51	123
May 17	do	2.89	272	Oct. 9	do	2.60	130
July 29	do	2.46	136	Dec. 20	F. F. Henshaw	[c] 3.03	67.1
Aug. 11	do	2.37	122				
11	do	1.94	43	1910.			
Sept. 7	do	5.20	1,100	Mar. 2	T. W. Norcross	6.80	2,240
26	do	2.77	225	2	do	6.76	2,230
1906.				1911.			
Mar. 21	T. W. Norcross	[a] 3.40	301	Mar. 8	F. J. Shuttleworth	2.56	140
Apr. 7	do	4.17	741	8	C. S. De Golyer	2.60	163
Oct. 18	F. E. Pressey	3.05	237				

[a] Discharge relation may have been affected by ice.
[b] Results uncertain; floating grass interfered with meter.
[c] Discharge relation affected by ice.

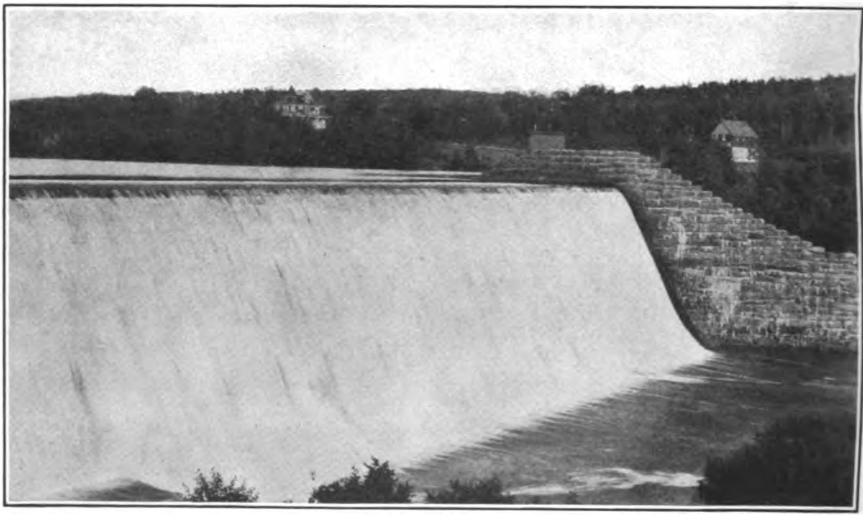
CROSSING, MASS., FEBRUARY 27, 1914.

oking upstream.

AT WEST WARE, MASS., OCTOBER 14, 1910.



A. QUABOAG RIVER AT WEST BRIMFIELD, MASS., FEBRUARY 28, 1914.



B. DAM ON CHICOPEE RIVER AT RED BRIDGE, MASS., AUGUST 30, 1914.

IBBS CROSSING, MASS.

idge at the point known as Gibbs Crossing
Vare.

to September 30, 1915.
age recorder on the right bank referred to gage
inclined staff gage used for auxiliary readings.
n the highway bridge or an electric railway

h and subject to a growth of aquatic plants
ee from weeds and practically permanent.
pen-water stage recorded: 5.9 feet, March 2,
Minimum stage recorded: 1.20 feet, October

cted by ice.
tion of mills above station.

at Gibbs Crossing, Mass., during 1912–1915.

s- ge.	Date.	Made by—	Gage height.	Dis- charge.
-ft.	1914.		*Feet.*	*Sec.-ft.*
3.0	Jan. 15	R. S. Barnes	[a]3.63	135
8.1	24	.....do	[a]3.48	329
3	25	.....do	[a]3.70	748
2	Feb. 11	.....do	[a]2.92	370
8	27	.....do	[a]3.98	237
	28	C. H. Pierce	[a]2.88	99.0
	Apr. 1	.....do	3.62	1,030
5	2	.....do	3.93	1,390
35	8	R. S. Barnes	3.57	959
09	Aug. 18	C. H. Pierce	1.42	22.0
07	18	.....do	1.42	19.7
00	Dec. 4	R. S. Barnes	1.62	37.3
30	20	.....do	[a]1.80	40.0
70				
36	1915.			
15.3	Jan. 4	R. S. Barnes	[a]3.85	174
24.9	5	.....do	[a]1.80	42.5
22.3	6	.....do	[a]3.50	147
	21	.....do	3.68	1,120
	Feb. 5	.....do	2.54	233
60	Mar. 1	.....do	3.38	774
.69				

relation affected by ice.

Daily discharge, in second-feet, of Ware River at Gibbs Crossing, Mass., for the years ending Sept. 30, 1912–1915.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.														
1	......	16	69	76	23	690	300	672	1,340	380	325	97	81	68
2	......	12	39	49	97	439	270	571	1,160	337	326	138	46	112
3	......	27	44	22	175	406	295	460	935	292	278	116	24	125
4	......	36	46	87	195	468	280	358	768	238	226	24	74	136
5	......	37	34	56	169	373	210	303	776	292	215	21	90	112
6	......	41	16	43	180	346	225	303	730	300	188	19	62	72
7	......	36	28	54	187	292	195	207	693	289	147	88	68	29
8	......	26	43	134	194	381	169	218	629	226	129	96	88	114
9	......	43	45	185	182	471	150	214	553	236	214	112	63	109
10	......	42	45	133	189	345	244	360	503	162	200	86	19	89
11	......	61	51	185	155	300	240	449	412	160	194	82	68	58
12	......	73	26	81	149	333	176	518	1,400	219	119	52	79	42
13	......	80	15	102	133	489	172	489	1,520	248	93	20	56	37
14	......	45	31	113	76	388	116	568	1,500	187	90	79	56	17
15	......	16	46	147	28	326	105	1,260	1,400	189	40	90	51	51
16	......	57	46	133	121	303	95	1,300	1,400	186	166	99	51	72
17	......	49	44	134	121	338	112	1,050	1,200	136	133	93	23	42
18	......	39	47	145	99	429	172	785	900	133	128	53	103	46
19	......	39	38	145	125	407	112	642	620	209	112	38	76	64
20	94	40	19	150	154	408	90	615	605	239	115	20	46	58
21	86	40	46	105	152	375	98	744	575	164	106	52	49	21
22	78	13	45	80	145	370	142	752	498	171	34	67	48	99
23	79	79	62	54	160	326	278	613	498	204	152	59	44	118
24	64	70	109	19	136	363	285	619	461	636	144	71	17	121
25	26	49	96	106	52	358	210	653	412	705	130	63	31	128
26	139	45	74	134	172	283	188	954	372	569	103	56	42	110
27	96	46	20	148	162	328	170	1,700	320	404	96	15	46	74
28	56	33	71	58	167	275	310	2,370	386	365	76	54	42	23
29	36	13	61	156	176	273	......	1,930	422	551	25	61	68	59
30	36	64	69	80	302	262	......	1,540	446	613	106	77	128	41
31	38	......	77	......	817	238	......	1,330	......	468	......	60	130	......

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	70	182	163	140	764	1,700	986	818	174	115	26	92
2	74	178	163	128	692	2,610	1,220	668	188	121	16	85
3	62	173	163	116	532	2,130	1,350	566	149	93	40	36
4	59	213	163	116	448	1,820	1,120	565	144	55	55	37
5	15	178	163	153	420	1,530	929	671	129	43	58	53
6	84	160	163	128	368	1,320	837	1,030	161	122	59	28
7	76	153	174	161	320	1,040	766	1,000	100	197	59	38
8	76	84	539	105	256	837	862	838	158	147	60	74
9	73	134	537	105	256	720	1,360	758	176	149	60	66
10	46	310	350	76	256	607	1,430	684	122	127	60	72
11	42	348	325	76	218	525	1,160	653	122	166	60	40
12	36	283	283	95	153	438	986	641	90	160	60	18
13	97	249	242	76	140	418	877	925	76	176	60	15
14	90	224	202	85	168	368	768	1,010	53	127	60	52
15	86	180	267	85	200	337	692	856	113	124	68	58
16	123	186	264	85	276	505	766	710	118	91	37	62
17	113	200	209	85	236	647	836	610	110	68	70	19
18	50	216	176	76	153	698	797	614	114	34	64	17
19	43	221	186	95	183	596	745	499	85	23	69	10
20	145	194	134	53	183	513	764	397	77	63	54	14
21	171	211	131	85	105	414	896	353	42	82	106	60
22	156	140	177	85	236	358	863	356	107	122	136	53
23	85	135	236	76	320	369	763	293	115	99	109	56
24	88	197	192	85	256	353	671	224	115	101	120	18
25	168	234	261	727	116	382	595	288	121	42	126	20
26	749	200	383	593	95	524	636	274	94	28	119	28
27	676	88	315	393	76	898	1,040	236	56	106	76	8.1
28	571	181	226	256	168	1,480	970	260	44	91	27	56
29	430	110	262	368	......	1,740	914	249	129	90	28	33
30	328	190	299	448	......	1,360	884	156	118	101	51	37
31	267	......	217	626	......	1,080	......	128	......	46	112	......

r at Gibbs Crossing, Mass., for the years ending
915—Continued.

o.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
36	669	138	195	141	108	187	159
18	511	131	198	148	137	264	150
59	424	72	239	118	304	359	150
68	343	108	236	88	338	523	60
23	308	149	200	24	229	1,350	50
00	282	188	217	17	238	1,370	140
20	241	232	176	56	222	1,340	136
38	281	235	191	59	179	975	130
29	284	252	219	76	555	750	119
48	236	273	226	90	714	571	105
168	237	263	222	89	443	480	25
140	230	537	192	21	398	378	21
174	157	598	165	11	358	377	78
142	134	466	155	58	273	386	78
393	209	379	110	63	260	305	79
240	238	324	109	72	209	342	80
956	169	290	207	68	118	314	81
660	169	212	121	62	112	267	24
529	163	232	120	21	149	217	19
420	99	269	115	16	240	210	81
343	96	253	102	67	201	148	114
368	176	189	82	70	228	129	190
343	192	204	133	68	242	212	182
420	153	153	191	70	175	208	132
,660	145	132	192	73	116	248	75
,230	138	195	131	61	140	182	29
,180	89	204	127	20	163	177	105
788	118	182	121	66	144	114	98
......	194	173	29	80	171	139	100
......	195	159	50	77	243	207	92
......	136	....	53	....	148	182	....

efined rating curve by averaging the discharge for short
iods varies from 1 to 6 hours. Discharge relation affected
ec. 16, 1914, to Jan. 18, 1915, and Feb. 1–5, 1915; estimates
nents, and climatic data.

Monthly discharge of Ware River at Gibbs Crossing, Mass., for the years ending Sept. 30 1912–1915.

[Drainage area, 201 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy
	Maximum.	Minimum.	Mean.	Per square mile.		
1912.						
August 20-31	139	26	69	0.343	0.15	A.
September	80	15	42	.209	.23	A.
1912–13.						
October	109	15	48	.239	.28	A.
November	185	19	104	.517	.58	A.
December	817	23	168	.836	.96	A.
January	690	238	367	1.83	2.11	A.
February	310	90	193	.960	1.00	C.
March	2,370	207	792	3.94	4.54	B
April	1,520	320	780	3.88	4.33	B.
May	705	133	307	1.53	1.76	A.
June	326	25	147	.731	.82	A.
July	138	15	66.4	.330	.38	A.
August	130	17	60.3	.300	.35	A.
September	136	17	74.9	.373	.42	A.
The year	2,370	15	259	1.29	17.53	
1913–14.						
October	749	15	166	.826	.95	A.
November	348	84	192	.955	1.07	A.
December	539	131	244	1.21	1.40	B.
January	727	53	185	.920	1.06	C.
February	764	76	271	1.35	1.41	C.
March	2,610	337	913	4.54	5.23	A.
April	1,430	595	916	4.56	5.09	A.
May	1,030	128	559	2.78	3.20	A.
June	188	42	113	.562	.63	A.
July	197	23	100	.498	.57	A.
August	136	16	67.9	.338	.39	B.
September	92	8.1	41.8	.208	.23	A.
The year	2,610	8.1	315	1.57	21.23	
1914–15.						
October	82	6.0	30.0	.149	.17	A.
November	85	6.6	34.3	.171	.19	A.
December	174	20	60.7	.302	.35	C.
January	2,370	25	413	2.05	2.36	C.
February	2,230	123	525	2.61	2.72	B.
March	669	89	226	1.12	1.29	A.
April	598	72	240	1.19	1.33	A.
May	239	29	156	.776	.89	A.
June	148	11	65.0	.323	.36	A.
July	714	108	244	1.21	1.40	A.
August	1,370	114	416	2.07	2.39	A.
September	190	19	96.1	.478	.53	A.
The year	2,370	6.0	207	1.03	13.98	

ver at Gibbs Crossing, Mass., during the years . 30, 1913–1915.

Days of deficiency in discharge.		
912–13	1913–14	1914–15
9	10	26
83	26	63
79	54	91
105	87	131
135	116	151
162	151	175
191	172	200
212	196	221
230	215	247
265	255	302
297	276	328
317	284	336
341	317	348
349	343	354
364	363	363
365	365	365

rsepower per foot fall that may be developed at different s on which the discharge and corresponding horsepower he columns for discharge and horsepower. In using this sses, the principal ones being the wheel loss, which may h may be as large as 5 per cent.

NEAR TEMPLETON, MASS.

m, 3 miles south of the village of Templeton,

mber 31, 1909.

on of spillway and tailrace.

wading.

m composed of rocks and coarse gravel. Con-

stage recorded: 1.4 feet, December 2, 1909; ium stage recorded: 0.35 foot at various times er; discharge 0.85 second-foot.

cted by ice.

e in reservoir above station.

ly once a day and the amount of regulation ered only approximate.

River near Templeton, Mass., during 1909.

s- rge.	Date.	Made by—	Gage height.	Discharge.
-ft.			*Feet.*	*Sec.-ft.*
4	Dec. 1	F. F. Henshaw........	a.40	1.0
1.8	16	W. Henshaw...........	a.92	6.9
4.3	17	F. F. Henshaw........	1.91	30
6.3	18	.....do................	1.14	11.1

on probably affected by ice.

Discharge, in second-feet, of Burnshirt River near Templeton, Mass., for 1909.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	13.0	2.2	1.1	0.85	7.8	2.2	0.8
2	....	11.9	1.8	1.1	.85	6.8	2.2	17.8
3	....	11.9	1.1	1.1	.85	6.0	2.7	4.5
4	....	10.8	1.1	3.8	.85	5.2	2.7	4.5
5	....	9.8	1.1	2.7	.85	4.5	2.7	4.5
6	....	9.8	1.8	1.8	.85	3.8	2.7	3.8
7	....	8.7	2.2	1.4	1.1	3.2	2.7	3.8
8	....	7.8	1.8	1.1	.85	2.7	2.2	4.5
9	....	7.8	1.8	1.1	.85	2.2	1.8	4.5
10	....	7.2	1.1	1.1	.85	2.2	1.4	4.5
11	....	7.8	.85	1.1	.85	3.8	1.8	4.5
12	....	7.8	.85	.85	.85	3.2	1.8	3.8
13	....	6.8	.85	.85	.85	2.7	1.8	2.7
14	....	6.8	.85	1.1	.85	2.7	1.8	3.8
15	....	6.0	.85	1.1	.85	2.2	1.8	5.2
16	....	5.2	.85	1.1	1.2	2.2	1.8	6.8
17	....	4.5	2.7	1.1	.85	2.2	2.2	7.8
18	....	6.0	2.7	1.1	.85	1.8	2.2	11.9
19	....	5.2	2.2	1.1	.85	2.2	2.7	3.8
20	....	5.2	1.8	.85	.85	2.2	2.7	4.5
21	....	4.9	1.8	.85	.85	2.2	2.7	3.8
22	....	4.5	1.4	.85	1.7	2.7	2.2	3.8
23	....	3.8	1.1	.85	.85	3.2	2.7	2.7
24	....	3.8	.85	1.0	.85	3.8	2.7	2.2
25	....	2.9	.85	.85	.85	3.8	3.8	2.2
26	8.7	3.2	.85	.85	1.1	3.2	3.2	2.0
27	11.9	3.2	.85	1.0	2.2	3.2	3.8	1.8
28	14.2	2.7	1.1	.85	3.8	3.2	4.5	1.8
29	4.5	2.2	2.2	.85	7.8	3.2	6.8	1.8
30	15.4	2.2	1.1	.85	11.9	2.7	6.8	1.4
31	14.2	....	1.1	.85	....	1.8	....	1.4

NOTE.—Discharge based on a rating curve which is well defined below discharge 30 second-feet, an represents the flow at time gage was read. No correction made for possible ice effect during Decembe

Monthly discharge of Burnshirt River near Templeton, Mass., during 1909.

[Drainage area, 8.4 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
May 26-31	15.4	4.5	11.5	1.37	0.3
June	13.0	2.2	6.45	.768	.8
July	2.7	.85	1.41	.168	.1
August	3.8	.85	1.17	1.39	.1
September	11.9	.85	1.65	.196	.2
October	7.8	1.8	3.31	.394	.4
November	6.8	1.4	2.77	.330	.3
December	17.8	.85	4.29	.511	.5

NOTE.—Monthly records considered only approximate.

SWIFT RIVER AT WEST WARE, MASS.

LOCATION.—Just below the timber dam (Pl. VIII, *B*) opposite the West Ware statio of the Boston & Albany Railroad, about 6 miles downstream from Enfield.

DRAINAGE AREA.—186[1] square miles.

RECORDS AVAILABLE.—July 15, 1910, to September 30, 1915.

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[1] Remeasured since published in previous reports.

nstream side of footbridge about 400 feet below
ugust 25, 1912; Barrett & Lawrence water-stage
feet below dam, August 25, 1912, to September
rred to gage datum by a hook gage inside the
l for auxiliary readings.

from cable about 50 feet above automatic gage

vel and alluvial deposits, some aquatic vegeta-
ntrol at ordinary stages is practically permanent;
the dam at Bondsville.

n stage recorded: 9.1 feet, February 26, 1915;
ed from an extension of the rating curve, 2,240
orded: 1.36 feet, September 22, 1914; discharge,

t seriously affected by ice.

Enfield 6 miles above station affects distribution
s, but has only a slight effect when the mean
nd-feet. The diurnal fluctuation is somewhat
age above the dam at West Ware, which has
l years. (See Water-Supply Paper 375, p. 132.)
ned and records of discharge as published con-
e marked diurnal fluctuation, mean daily and
omputed for period prior to installation of auto-
fig. 2.)

iver at West Ware, Mass., during 1910–1915.

Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
c.-ft.	1913.		*Feet.*	*Sec.-ft.*
102	Feb. 12	C. S. De Golyer	2.58	191
70.4	Mar. 12	J. G. Mathers	3.66	465
145	12	C. S. De Golyer	3.66	465
	27	O. W. Hartwell	5.53	987
	27	do	5.62	1,010
131	Aug. 11	C. H. Pierce	1.47	33.8
	1914.			
138	Jan. 3	R. S. Barnes	2.40	150
376	15	do	[a] 2.10	82.9
31.5	24	do	[a] 2.10	61.1
30.9	Feb. 11	do	[a] 2.99	209
85.2	27	C. H. Pierce	[a] 2.57	152
70.3	Aug. 17	do	1.76	63.0
125	17	do	1.80	65.0
121	Dec. 4	R. S. Barnes	1.80	66.0
172	20	do	1.83	59.6
151				
145	1915.			
133	Jan. 5	R. S. Barnes	[a] 1.90	59.0
	Feb. 5	do	[a] 2.53	145
	Apr. 14	do	4.69	791
420	14	do	4.68	788
394	Sept. 30	Hardin Thweatt	2.05	106

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relation affected by ice.

r 18, 1912, somewhat uncertain on account of defective hook
r to the hook gage.

Discharge, in second-feet, of Swift River at West Ware, Mass., for 1910–1912.

Day.	July.				August.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1910.								
1	......	......	......	......	7.00	44	8.15	105
2	......	......	......	......	6.45	48	7.25	116
3	......	......	......	......	7.00	48	6.15	92
4	......	......	......	......	6.45	48	6.15	95
5	......	......	......	......	7.00	57	7.00	122
6	......	......	......	......	7.00	57	7.30	82
7	......	......	......	......	11.55	105	......	......
8	......	......	......	......	6.45	108	5.45	142
9	......	......	......	......	6.45	82	6.45	137
10	......	......	......	......	6.45	69	6.00	131
11	......	......	......	......	6.45	78	5.45	122
12	......	......	......	......	6.30	69	7.30	131
13	......	......	......	......	7.30	57	7.15	112
14	......	......	......	......	11.45	57	......	......
15	......	......	6.35	95	6.45	78	6.00	131
16	6.55	44	5.15	82	6.55	59	5.45	131
17	11.15	48	......	......	6.45	50	6.25	134
18	7.00	35	6.15	86	6.35	50	5.30	122
19	7.00	48	7.30	95	7.15	61	6.45	147
20	7.00	44	7.30	82	6.55	57	6.00	102
21	6.45	41	7.45	80	11.45	44	......	......
22	7.00	41	5.40	80	7.00	57	6.40	126
23	6.45	42	7.00	48	7.00	50	7.00	122
24	......	......	1.15	42	6.35	59	6.45	105
25	6.30	38	6.45	105	6.45	50	5.45	102
26	6.55	42	6.30	90	7.00	48	6.30	90
27	7.00	42	6.45	74	6.45	46	5.20	57
28	7.00	44	6.30	71	11.55	42	......	......
29	7.00	42	6.45	69	6.55	42	6.15	122
30	6.55	41	7.10	61	6.35	42	7.00	116
31	11.45	44	......	......	6.30	41	7.10	105
	September.				October.			
1	6.35	41	5.00	95	7.00	42	6.00	74
2	7.00	38	6.15	105	......	......	12.00	50
3	6.45	35	6.15	57	7.30	42	6.00	50
4	......	......	12.15	46	7.00	38	5.30	102
5	7.00	54	5.30	74	7.30	41	6.00	80
6	7.00	74	6.00	166	7.30	44	5.30	82
7	7.00	71	6.00	137	7.30	44	5.30	82
8	6.45	61	6.45	142	7.15	44	5.30	50
9	7.00	78	6.00	159	......	......	1.30	30
10	7.00	78	5.55	134	7.30	67	6.00	116
11	......	......	1.30	86	7.30	59	5.30	108
12	7.00	92	7.00	137	7.30	35	6.55	74
13	6.45	59	6.10	137	7.30	35	5.30	105
14	6.50	57	6.00	150	7.15	35	5.30	102
15	7.00	54	5.30	126	7.15	35	5.30	64
16	7.00	50	6.10	131	11.00	38	......	......
17	7.00	46	6.30	50	7.30	36	5.50	108
18	......	......	1.30	46	7.15	36	5.45	105
19	7.00	46	6.00	184	7.15	35	5.45	98
20	7.00	50	5.30	116	7.30	36	5.30	105
21	7.00	41	5.30	102	7.15	36	5.30	105
22	7.00	41	6.00	116	7.15	35	5.30	102
23	7.00	38	6.10	92	......	......	1.15	35
24	7.00	38	6.00	64	7.15	35	5.30	105
25	......	......	12.10	38	7.15	44	5.30	105
26	7.15	42	6.15	126	7.00	48	5.40	112
27	7.15	46	6.05	82	7.15	42	5.20	69
28	7.15	18	6.00	50	7.15	42	5.00	86
29	7.00	48	6.00	92	7.15	38	5.00	74
30	7.15	42	6.15	80	......	......	12.30	35
31	......	......	......	......	7.30	35	5.00	74

t West Ware, Mass , for 1910–1912—Contd.

ovember.			December.			
	P. M.		A. M.		P. M.	
is-rge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
42	5.00	74	7.30	59	4.30	150
42	5.30	80	7.30	61	4.30	126
52	5.00	122	7.30	59	4.30	102
48	5.30	150	11.30	64	....	....
80	5.30	131	7.45	69	4.30	142
.....	1.30	112	7.45	69	4.30	116
122	5.00	168	7.45	69	4.30	116
122	5.00	168	7.45	54	4.30	122
105	5.00	150	7.45	50	4.30	122
112	5.00	150	7.45	54	4.30	122
105	5.00	154	....	....	1.15	48
105	5.00	150	7.45	54	4.30	105
108	....	....	7.45	54	4.30	122
92	5.00	112	7.45	46	4.30	92
61	5.00	105	7.45	44	4.30	95
59	5.00	150	7.45	59	5.00	92
59	5.00	116	7.45	57	5.00	74
50	5.00	126	....	....	1.30	44
52	5.00	92	7.45	50	5.00	126
......	1.30	92	7.45	46	4.30	98
67	5.00	131	7.45	46	4.30	108
59	4.45	116	7.45	59	5.00	102
86	4.00	108	7.45	59	5.00	102
52	4.30	52	7.45	71	5.00	303
67	4.30	69	11.30	150	....	....
59	4.30	67	7.45	154	4.45	172
52	....	....	7.45	208	4.30	212
59	4.00	137	7.45	208	4.30	198
59	4.30	134	7.45	187	4.30	187
59	4.30	150	7.45	198	4.30	187
....	....	....	7.30	172	4.30	187
January.			February.			
178	....	....	7.45	230	5.00	208
178	4.30	208	7.45	230	5.00	142
230	4.30	277	7.45	154	5.00	150
344	4.30	373	7.45	122	5.00	168
427	4.30	373	....	....	1.30	168
420	4.30	336	7.45	137	5.00	154
277	4.30	258	7.45	137	5.00	154
208	....	....	7.45	134	5.00	159
208	4.30	198	7.45	126	5.00	183
172	4.30	208	7.45	116	5.00	168
172	4.30	198	7.45	123	5.00	168
178	4.30	178	....	....	1.30	116
172	4.30	178	7.45	116	5.00	168
168	4.30	134	7.45	92	5.00	168
154	....	....	7.45	95	5.00	159
95	4.30	159	7.45	95	5.00	168
159	5.00	168	7.45	98	5.00	168
134	5.00	172	7.45	82	5.00	137
105	5.00	159	....	....	1.30	105
80	5.00	122	7.45	95	5.00	168
98	5.00	95	7.45	92	5.00	142
105	....	....	7.45	159	5.00	126
98	5.00	142	7.45	86	5.00	134
61	5.00	122	7.45	80	5.00	80
59	5.00	142	7.45	102	5.00	102
59	5.00	122	11.45	105	....	....
52	5.00	134	7.30	122	4.30	325
187	5.00	219	7.30	208	4.30	198
230	....	....	....	....	....	....
242	5.00	230	....	....	....	....
198	5.00	230	....	....	....	....

Discharge, in second-feet, of Swift River at West Ware, Mass., for 1910–1912—**Contd.**

Day.	March.				April.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.	Time.	Dis-charge.
1911.								
1	7.30	187	4.30	187	7.30	1,040	6.00	877
2	7.30	191	4.30	191	11.45	682	....	....
3	7.30	168	4.30	168	7.30	509	5.00	445
4	7.30	150	4.30	168	7.30	420	5.00	358
5	11.45	137	....	....	7.30	344	5.00	336
6	7.30	105	4.30	116	7.30	358	5.00	528
7	7.30	80	5.00	168	7.30	628	5.00	777
8	7.30	80	5.00	150	7.30	915	5.00	868
9	7.30	80	5.00	154	....	....	1.15	786
10	7.30	86	5.00	116	7.30	640	5.00	607
11	7.30	112	5.00	164	7.30	607	5.00	567
12	....	....	1.30	134	7.30	528	5.00	497
13	7.30	108	5.00	191	7.30	490	5.00	454
14	7.30	122	5.00	187	7.00	420	6.00	420
15	7.30	420	5.00	628	7.30	490	6.00	528
16	7.30	682	6.00	733	....	....	1.15	547
17	7.30	528	5.00	587	7.30	509	5.00	509
18	7.30	490	6.00	388	7.30	509	6.00	454
19	11.45	567	....	....	7.30	394	6.00	373
20	7.00	258	5.00	388	7.30	388	5.30	373
21	7.30	277	5.00	325	7.30	344	6.00	336
22	7.30	303	5.00	317	7.30	358	6.00	344
23	7.30	358	5.00	364	....	....	1.30	325
24	7.30	344	6.00	358	7.00	303	5.00	316
25	7.30	325	5.00	336	7.30	316	5.00	316
26	11.15	303	....	....	7.30	282	6.00	290
27	7.30	290	5.00	420	7.30	303	6.00	277
28	7.30	938	5.00	1,350	7.30	277	6.00	282
29	7.30	1,350	5.00	1,240	7.30	277	6.00	265
30	7.30	1,260	5.00	1,270	11.30	277	....	....
31	7.30	1,380	5.00	1,290	....	....	....	....
	May.				June.			
1	7.30	253	6.00	265	7.00	187	6.00	208
2	7.30	277	6.00	282	7.00	126	6.00	134
3	7.30	290	5.00	290	7.00	126	6.00	122
4	7.30	277	6.00	265	11.00	150	....	....
5	7.30	265	6.00	265	7.00	134	6.00	177
6	7.30	230	6.00	230	7.00	150	6.00	187
7	11.00	235	....	....	7.00	112	6.00	187
8	7.30	208	6.00	208	7.00	105	6.00	105
9	7.00	219	6.00	230	7.00	92	6.00	105
10	7.30	219	6.00	212	7.30	126	6.00	112
11	7.30	191	6.00	198	11.00	150	....	....
12	7.30	208	6.00	208	7.00	150	6.00	168
13	7.00	187	6.00	187	7.30	92	6.00	198
14	11.00	191	....	....	7.00	108	6.00	191
15	7.30	164	6.00	168	7.00	105	6.00	191
16	7.00	168	6.00	168	7.00	112	6.00	168
17	7.00	150	6.00	168	7.00	116	6.00	150
18	7.00	150	6.00	150	11.45	122	....	....
19	7.00	150	6.00	172	7.00	108	6.00	154
20	7.00	198	6.00	242	7.00	82	6.00	168
21	11.00	265	....	....	7.00	82	6.00	134
22	7.00	253	6.00	253	7.00	74	6.00	147
23	7.30	253	6.00	230	7.00	74	6.00	142
24	7.30	219	6.00	226	7.00	74	6.00	106
25	7.00	208	6.00	212	11.00	74	....	....
26	7.00	208	6.00	198	7.00	69	6.00	134
27	7.00	198	6.00	187	7.00	69	6.00	134
28	....	....	1.30	183	7.00	69	6.00	122
29	7.00	159	6.00	187	7.00	64	6.00	126
30	7.00	134	6.00	142	7.00	64	6.00	126
31	7.00	142	6.00	187	....	....	....	....

at West Ware, Mass., for 1910–1912—Contd.

July.			August.			
	P. M.		A. M.		P. M.	
is- arge.	Time.	Dis- charge.	Time.	Dis- charge.	Time.	Dis- charge.
61	6.00	122	6.30	74	6.30	80
61	....	....	7.30	69	6.30	80
59	6.00	122	7.30	61	5.30	134
59	6.00	67	7.30	54	6.00	80
64	6.00	122	7.30	50	6.00	80
59	6.00	122	11.00	50	....	....
59	6.00	126	7.30	86	6.30	134
61	6.00	122	7.30	54	6.30	105
59	....	....	7.30	54	6.00	116
50	6.00	69	7.30	50	6.30	105
54	6.00	80	7.30	50	6.30	92
54	6.00	80	7.30	54	6.30	92
50	6.00	80	11.00	54	....	....
50	6.00	74	7.30	54	6.30	126
50	6.00	69	7.30	52	6.30	134
....	1.30	48	7.30	92	6.00	150
46	6.30	69	7.00	69	6.30	147
50	6.30	92	7.30	71	6.30	126
50	6.30	92	7.30	98	6.00	80
46	6.30	95	....	....	1.30	86
50	6.30	92	7.30	86	6.30	134
48	6.30	92	7.30	69	6.00	150
50	....	....	7.00	59	6.30	134
48	6.30	122	7.30	59	6.30	142
69	6.30	142	7.30	59	6.30	142
64	6.30	142	7.30	59	6.00	69
64	6.30	142	11.45	71	....	....
64	6.30	105	7.30	86	6.30	92
116	5.30	112	7.30	105	6.00	198
112	....	....	7.30	134	6.30	218
116	6.30	92	7.30	218	6.30	265
September.			October.			
277	6.00	277	....	....	1.30	116
253	6.00	248	7.30	134	6.00	168
230	....	....	7.30	142	5.30	208
198	6.00	154	7.30	142	5.30	244
154	6.00	142	7.30	187	5.30	230
150	6.30	172	7.30	198	5.00	198
116	6.30	126	7.30	208	5.00	219
105	6.00	178	10.30	219	....	....
95	6.00	178	7.30	219	5.00	244
137	....	....	7.30	219	5.00	208
122	6.00	187	7.30	172	5.00	208
92	6.00	187	7.30	168	5.00	187
92	6.30	126	7.30	137	5.00	142
86	6.00	168	7.30	137	5.00	142
92	6.00	122	11.00	134	....	....
112	6.00	95	7.30	126	6.00	178
116	....	....	7.30	98	5.30	187
92	6.00	116	7.30	92	5.00	230
86	6.00	137	7.30	699	5.00	822
92	6.00	168	7.30	1,260	5.00	1,260
92	6.00	142	7.30	1,110	5.00	1,010
80	6.00	122	11.00	1,150	....	....
82	6.00	134	7.30	1,240	5.00	1,320
92	....	....	7.30	1,240	5.00	1,210
90	6.00	142	7.30	1,010	5.00	1,010
74	6.00	142	7.30	786	5.00	733
69	6.00	150	7.30	669	5.00	607
86	6.00	134	7.30	548	5.00	548
69	6.00	150	11.00	454	....	....
71	6.00	150	7.30	388	5.00	373
....	....	....	7.30	358	5.00	358

Discharge, in second-feet, of Swift River at West Ware, Mass., for 1910–1912—**Contd.**

Day.	November.				December.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Dis- charg
1911.								
1	7.30	344	5.00	358	7.30	454	5.00	4
2	7.30	344	5.00	358	7.30	454	5.00	4
3	7.30	325	5.00	344	11.00	388	......	......
4	7.30	336	5.00	344	7.30	358	5.00	3
5	11.00	290	......	......	7.30	358	5.00	3
6	7.30	265	5.00	303	7.30	358	5.00	3
7	7.30	325	5.00	344	7.30	316	5.00	3
8	7.30	388	5.00	388	7.30	290	5.00	2
9	7.30	358	5.00	388	7.30	290	5.00	2
10	7.30	358	5.00	358	11.00	290	......	......
11	7.30	344	5.00	358	7.30	265	4.00	27
12	......	......	1.30	344	7.30	303	4.00	31
13	7.30	358	5.00	358	7.30	303	4.00	30
14	7.30	364	5.00	358	7.30	303	4.00	30
15	7.30	420	5.00	437	7.30	303	4.00	33
16	7.30	454	5.00	461	7.30	344	4.00	35
17	7.30	472	5.00	472	11.30	454	......	......
18	7.30	498	5.00	528	7.30	528	4.00	54
19	11.00	648	......	......	7.30	567	4.00	52
20	7.30	712	5.00	712	7.30	454	4.00	45
21	7.30	712	5.00	712	7.30	420	4.00	42
22	7.30	648	5.00	682	7.30	373	4.00	37
23	7.30	567	5.00	548	7.30	548	4.00	56
24	7.30	509	5.00	567	10.30	712	......	......
25	7.30	628	5.00	628	7.30	733	4.00	73
26	11.00	607	......	......	7.30	712	4.00	73
27	7.30	607	5.00	607	7.30	648	4.00	69
28	7.30	587	5.00	587	7.30	615	4.00	62
29	7.30	567	5.00	567	7.30	528	4.00	52
30	7.30	490	5.00	490	7.30	548	4.00	54
31	......	......	......	......	11.30	420	......	......

1912.	March.				April.			
1	......	......	......	......	7.30	1,690	5.00	1,57
2	......	......	......	......	7.30	1,430	5.00	1,51
3	......	......	......	......	7.30	1,690	5.00	1,81
4	......	......	......	......	7.30	1,930	5.00	1,81
5	......	......	......	......	7.30	1,620	5.00	1,51
6	......	......	......	......	7.30	1,390	5.00	1,39
7	......	......	......	......	......	......	1.30	1,12
8	......	......	......	......	7.30	1,170	5.00	1,33
9	......	......	......	......	7.30	1,330	5.00	1,31
10	......	......	......	......	7.30	1,220	5.00	1,12
11	......	......	......	......	7.30	1,020	5.00	1,01
12	......	......	......	......	7.30	924	5.00	83
13	......	......	......	......	7.30	986	5.00	74
14	......	......	......	......	11.00	699	......	......
15	......	......	......	......	7.30	656	5.00	65
16	......	......	......	......	7.30	699	5.00	69
17	......	......	......	......	7.30	786	5.00	78
18	......	......	5.00	2,390	7.30	813	5.00	831
19	7.30	1,880	5.00	1,690	7.30	924	5.00	972
20	7.30	1,510	5.00	1,390	7.30	877	5.00	877
21	7.30	1,270	5.00	1,170	11.00	786	......	......
22	7.30	972	5.00	953	7.30	724	5.00	[illegible]
23	7.30	813	5.00	742	7.30	724	5.00	699
24	11.00	656	......	......	7.30	699	5.00	656
25	7.30	607	5.00	536	7.30	607	5.00	607
26	7.30	498	5.00	536	7.30	575	5.00	575
27	7.30	498	5.00	536	7.30	498	5.00	498
28	7.30	498	5.00	575	11.00	447	......	......
29	7.30	628	5.00	1,200	7.30	427	5.00	427
30	7.30	1,390	5.00	1,750	7.30	461	5.00	461
31	11.00	2,000	......	......	......	......	......	......

at West Ware, Mass., for 1910-1912—Contd.

May.			June.			
	P. M.		A. M.		P. M.	
is- rge.	Time.	Dis- charge.	Time.	Dis- charge.	Time.	Dis- charge.
498	5.00	472	6.00	483	6.00	498
461	6.00	461	11.00	498	....	....
461	6.00	461	6.00	461	6.00	427
414	6.00	394	6.00	382	6.00	364
336	....	....	6.00	352	6.00	325
336	6.00	336	6.00	298	6.00	308
394	6.00	394	6.00	298	6.00	298
427	6.00	447	6.00	258	6.00	248
461	6.00	575	11.00	226	....	....
607	6.00	575	6.00	212	6.00	212
575	6.00	575	6.00	212	6.00	191
559	....	....	6.00	191	6.00	191
559	6.00	536	6.00	172	6.00	172
536	6.00	536	6.00	168	6.00	168
536	6.00	536	6.00	164	6.00	164
575	6.00	607	11.00	154	....	....
742	6.00	786	6.00	147	6.00	154
1,070	6.00	972	6.00	102	6.00	164
877	....	....	6.00	102	6.00	154
786	6.00	699	6.00	108	6.00	78
640	6.00	640	6.00	46	6.00	32
656	6.00	599	6.00	116	6.00	112
599	6.00	575	11.00	116	....	....
548	6.00	640	6.00	108	6.00	102
699	6.00	575	6.00	90	6.00	82
483	....	....	6.00	78	6.00	78
427	6.00	427	6.00	75	6.00	137
394	6.00	364	6.00	71	6.00	131
352	6.00	344	6.00	59	6.00	90
336	6.00	364	11.00	61	....	....
437	6.00	461	....	....	....	....
July.			August.			
71	6.00	126	6.00	36	6.00	92
57	6.00	122	6.00	36	6.00	116
57	6.00	116	6.00	41	6.00	48
52	6.00	108	11.00	36	....	....
48	6.00	98	6.00	52	6.00	52
61	6.00	82	6.00	41	6.00	108
57	....	....	6.00	41	6.00	102
52	6.00	108	6.00	38	6.00	92
52	6.00	98	6.00	36	6.00	108
48	6.00	92	6.00	36	6.00	108
46	6.00	82	11.00	41	....	....
48	6.00	90	7.00	44	6.00	122
41	6.00	82	7.00	44	6.00	108
44	....	....	7.00	36	6.00	92
48	6.00	137	7.00	36	6.00	71
61	6.00	98	7.00	34	6.00	71
46	6.00	108	7.00	28	6.00	71
41	6.00	122	....	....	1.30	41
44	6.00	82	7.00	36	6.00	137
41	6.00	71	7.00	48	6.00	122
71	....	....	7.00	41	6.00	102
74	6.00	122	6.00	36	6.00	122
64	6.00	98	6.00	32	6.00	108
57	6.00	92	6.00	34	6.00	80
64	6.00	137	11.00	41	....	....
52	6.00	137	6.00	35	6.00	105
46	6.00	108	7.00	36	6.00	116
71	....	....	7.00	26	6.00	74
52	6.00	116	7.00	26	6.00	74
48	6.00	147	7.00	26	6.00	74
38	6.00	122	7.00	26	6.00	74

well defined rating curve, referred to the chain gage. Dis-
17, 1912.

Daily discharge, in second-feet, of Swift River at West Ware, Mass., for the years endin
Sept. 30, 1912–1915.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1912–13.														
1	......	......	64	58	79	459	260	477	990	389	512	86	48	
2	......	......	61	59	104	440	278	503	913	357	406	84	46	
3	......	......	56	38	110	417	256	484	799	330	342	81	40	
4	......	67	54	80	117	435	268	435	698	305	291	35	45	
5	......	......	48	64	120	411	237	379	651	269	263	50	43	
6	......	......	24	66	142	359	239	321	642	267	228	60	44	
7	......	......	58	64	162	323	229	300	607	295	197	80	45	
8	......	......	54	101	163	373	214	301	572	252	182	74	49	
9	......	......	36	184	159	456	183	271	529	232	158	66	40	
10	......	......	48	188	135	409	165	295	487	218	155	60	31	
11	......	......	47	153	132	407	176	384	508	207	152	59	43	
12	......	......	46	149	122	401	160	440	800	181	149	50	43	
13	......	......	24	131	105	422	184	452	1,040	186	137	43	40	
14	......	......	45	130	93	408	162	516	1,090	185	126	60	38	
15	......	26	77	135	79	368	153	656	1,010	181	104	62	38	
16	......	55	60	140	105	330	142	863	875	199	122	52	38	
17	......	61	52	145	87	318	138	888	756	199	107	55	29	
18	......	66	51	140	88	369	119	765	643	172	104	57	41	
19	......	62	44	121	103	414	131	634	572	160	97	47	42	
20	......	62	24	112	139	422	143	554	520	161	107	35	49	
21	......	51	58	106	146	417	150	579	475	159	102	55	42	
22	......	32	55	97	126	395	190	634	454	172	82	59	40	
23	......	68	48	84	133	371	284	626	425	250	105	55	41	
24	......	62	64	82	119	372	309	591	398	645	103	58	24	
25	37	57	69	105	124	377	315	599	394	588	104	57	46	
26	73	55	63	104	115	346	273	700	361	580	97	56	42	
27	68	54	41	112	116	332	239	1,020	323	496	95	50	32	
28	57	35	84	83	143	311	358	1,660	325	416	80	56	37	
29	53	55	71	95	147	279	......	1,820	399	502	65	54	44	
30	52	67	53	92	224	258	......	1,470	396	455	97	53	79	
31	44	......	59	......	378	241	......	1,150	......	445	......	51	51	......

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1913–14.												
1	45	176	156	152	605	385	980	695	210	107	45	
2	55	150	164	133	620	893	1,010	639	202	127	45	
3	60	127	168	152	519	1,190	1,160	558	196	125	40	
4	55	116	164	152	441	1,340	1,100	518	196	113	40	
5	45	109	154	133	402	1,280	951	558	206	107	40	
6	95	102	144	124	340	1,100	807	723	202	115	40	
7	95	100	150	124	315	864	751	807	202	125	40	
8	85	88	255	124	265	667	779	779	198	125	40	
9	76	117	328	124	265	531	1,040	695	182	125	40	
10	52	152	325	124	228	450	1,310	639	164	121	40	
11	52	176	287	108	193	396	1,190	572	145	113	40	
12	25	186	240	100	162	359	1,010	558	139	145	40	
13	47	172	209	93	152	333	864	695	137	147	40	
14	62	156	193	93	116	302	751	807	127	149	40	
15	64	146	172	93	142	310	681	807	120	143	40	
16	58	140	164	86	142	359	695	723	117	143	45	
17	51	133	168	86	142	464	723	612	113	152	65	
18	41	131	160	79	142	531	723	544	110	154	64	
19	23	126	152	73	133	544	751	490	120	137	67	
20	82	134	131	73	142	490	723	450	143	104	78	
21	119	138	129	67	142	412	779	418	132	89	112	
22	114	126	133	67	142	377	864	391	123	85	158	
23	111	182	127	61	142	330	779	361	107	81	184	
24	112	133	188	61	152	333	695	335	115	79	188	
25	193	117	260	228	152	333	612	310	118	77	166	
26	328	109	300	193	152	418	626	294	104	76	145	
27	431	93	292	204	152	626	807	284	81	80	125	
28	436	97	235	252	152	1,040	835	297	100	80	109	
29	365	124	223	252	......	1,490	807	280	100	80	104	
30	285	142	186	302	......	1,460	751	253	100	80	104	
31	218	......	174	441	......	1,190	......	230	......	80	94	......

River at West Ware, Mass., for the years ending –1915—Continued.

eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
143	896	156	389	101	136	376	180
152	655	145	461	109	172	475	166
150	520	132	420	109	280	640	154
139	368	134	389	102	355	728	145
136	342	150	342	95	360	1,610	141
158	304	200	312	88	322	1,800	130
241	292	239	282	74	335	1,760	121
277	267	245	275	72	270	1,360	121
270	267	255	275	78	565	1,020	121
239	255	262	270	76	925	795	113
217	243	317	257	68	848	610	106
176	239	565	228	66	672	490	102
145	217	865	208	62	535	444	98
134	204	795	188	59	397	447	95
210	184	655	172	56	320	417	100
550	196	505	152	64	277	391	98
655	187	404	149	71	215	347	113
595	177	368	164	74	194	307	94
505	168	335	164	72	188	267	88
404	160	320	156	78	221	241	84
356	143	297	145	78	267	215	121
330	147	277	166	81	280	213	150
325	166	260	174	86	272	241	139
399	164	245	176	86	267	243	139
490	162	234	184	77	272	260	136
200	174	221	172	81	248	234	130
800	162	230	162	79	248	213	125
270	150	230	147	72	282	198	117
....	143	225	128	71	368	188	109
....	162	239	118	71	391	186	95
....	160	....	106	.a....	391	188	....

ned rating curve. Discharge relation affected by ice as Jan. 20, 1915, and Jan. 30 to Feb. 24, 1915. Discharge 1915, and Jan. 30 to Feb. 24, 1915, based on gage-height a. Discharge Feb. 1, 19, and 28, May 23, 24, and 29–31, Oct. 8, 1913; June 28–30, and July 27 to Aug. 16, 1914, in adjacent drainage basins.

Ware, Mass., for the years ending Sept. 30, 12–1915.

a, 186 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
um.	Minimum.	Mean.	Per square mile.		
84	24	53.0	0.285	0.33	B.
188	38	107	.575	.64	B.
378	79	133	.715	.82	A.
459	241	375	2.02	2.33	A.
358	119	213	1.15	1.20	A.
820	271	670	3.60	4.15	B.
080	323	622	3.34	3.73	B.
645	159	305	1.64	1.89	A.
512	65	162	.871	.97	A.
86	35	58.1	.312	.36	B.
79	24	42.3	.227	.26	B.
84	28	57.7	.310	.35	A.
820	24	233	1.25	17.03	

Monthly discharge of Swift River at West Ware, Mass., for the years ending Sept. 30, 1912–1915—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1913–14.						
October	436	23	125	0.672	0.77	B.
November	186	88	131	.704	.79	A.
December	328	127	198	1.06	1.22	A.
January	441	61	140	.753	.87	C.
February	620	116	238	1.28	1.33	C.
March	1,490	302	671	3.61	4.16	B.
April	1,310	612	852	4.58	5.11	B.
May	807	230	527	2.83	3.26	B.
June	210	81	144	.774	.86	B.
July	154	76	112	.602	.69	B.
August	188	40	78.0	.419	.48	C.
September	100	32	53.0	.285	.32	B.
The year	1,490	23	272	1.46	19.86	
1914–15.						
October	59	30	40.8	.219	.25	B.
November	81	38	57.0	.306	.34	B.
December	76	42	58.1	.312	.36	C.
January	1,180	36	326	1.75	2.02	C.
February	2,200	134	488	2.62	2.73	C.
March	895	143	254	1.37	1.58	B.
April	865	132	317	1.70	1.90	B.
May	461	106	224	1.20	1.38	B.
June	109	56	78.5	.422	.47	B.
July	925	136	351	1.89	2.18	B.
August	1,800	186	545	2.93	3.38	B.
September	180	84	121	.651	.73	B.
The year	2,200	30	237	1.27	17.32	

Days of deficiency in discharge of Swift River at West Ware, Mass., during the years ending Sept. 30, 1913–1915.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.		
		1912–13	1913–14	1914–15
40	4.6	19	10	18
60	6.8	92	51	70
80	9.1	125	73	117
100	11.4	148	98	131
125	14.2	177	143	148
150	17.0	200	189	172
175	19.9	217	220	201
200	22.7	231	235	220
300	34.1	259	263	286
400	45.5	294	286	317
500	56.8	322	299	330
750	85.2	348	329	347
1,000	114	357	350	355
1,500	170	363	365	360
2,500	284	365	....	365

Note.—The above table gives the theoretical horsepower per foot fall that may be developed at different rates of discharge, and shows the number of days on which the discharge and corresponding horsepower were respectively less than the amounts given in the columns for discharge and horsepower. In using this table, allowance should be made for the various losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

T WEST WARREN, MASS.

Donnell at West Warren.

r 18, 1903; October 25, 1904, to April 30, 1907.
ed by the Massachusetts State Board of Health
Vertical staff on left bank near headgates of
r 25, 1904, to April 30, 1907.
surement was made by wading below dam.
e crest of the timber crib dam; length, 102.7

stage recorded: 52.2 feet, March 28, 1905;
num stage recorded: 50.15 feet, July 21, 1905;

affected by ice.
ration of mills above station. The diurnal
that it is considered impossible to compute
om one gage reading a day.
neans of a weir formula; record only fair.
1 to October 18, 1903, furnished by Massa-

was made by F. E. Pressey:
eet; discharge, 173 second-feet.

boag River at West Warren, Mass., for 1903.

.	Day.	July.	Aug.	Sept.	Oct.
52	16	[a] 197	....	151	102
81	17	....	....	233	151
78	18	....	....	208	202
05	19	....	....	178	....
90	20	[a] 158	....	164	....
82	21	219	[a] 109	151	....
96	22	225	111	125	....
99	23	228	106	133	....
144	24	209	101	123	....
145	25	182	120	115	....
140	26	172	113	110	....
158	27	160	116	129	....
148	28	150	119	[a] 158	....
118	29	145	136	....	....
108	30	136	146	....	....
	31	150	136	....	....

than 24 hourly readings.

3, obtained from automatic gage records and furnished by

Discharge, in second-feet, of Quaboag River at West Warren, Mass., for 1904–1907.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1904–5.												
1	......	182	141	a 123	123	123	931	229	106	106	41	72
2	......	161	89	123	123	123	a 857	212	106	a 106	30	89
3	......	141	89	205	106	106	820	195	89	89	30	a 476
4	......	141	a 72	123	106	106	820	178	a 89	72	41	476
5	......	182	72	123	a 123	a 106	783	161	89	72	30	416
6	......	a 106	89	161	123	106	783	161	89	55	a 30	387
7	......	106	72	254	123	123	747	a 161	89	55	41	332
8	......	72	89	a 571	141	141	711	161	72	72	41	280
9	......	30	72	605	141	182	a 711	161	89	a 72	30	205
10	......	41	89	539	161	280	711	141	72	72	41	a 205
11	......	30	a 55	507	141	280	675	141	a 89	55	41	205
12	......	72	55	446	a 123	a 254	640	141	89	72	41	205
13	......	a 30	41	416	123	254	605	123	89	89	a 55	182
14	......	30	30	387	106	280	571	a 123	89	72	55	205
15	......	41	30	a 358	106	280	539	123	89	55	41	182
16	......	55	30	332	89	306	a 539	123	72	a 72	55	161
17	......	89	20	306	106	332	539	141	72	72	55	a 161
18	......	106	a 10	306	106	358	539	141	a 72	55	72	161
19	......	89	20	254	a 106	a 711	507	161	72	55	72	161
20	......	a 89	30	254	106	711	476	161	72	41	a 72	182
21	......	106	30	254	106	747	446	a 161	55	20	72	161
22	......	106	20	a 205	123	783	416	161	72	30	55	161
23	......	89	30	205	141	820	a 358	141	89	a 41	72	141
24	......	72	41	182	141	894	332	141	106	41	72	a 141
25	106	89	a 30	161	123	1,000	306	141	a 106	30	55	141
26	141	72	30	161	a 123	a 1,120	306	123	106	41	55	141
27	161	a 55	229	141	123	1,160	280	123	106	41	a 55	123
28	161	30	229	141	106	1,210	254	a 123	89	30	55	123
29	141	30	229	a 141	......	1,160	254	123	106	41	55	123
30	a 182	30	141	141	......	1,120	a 229	106	106	a 41	41	106
31	182	......	141	141	......	1,080	......	106	......	55	55	......
1905–6.												
1	a 106	89	89	106	205	280	a 605	358	571	a 205	161	106
2	106	89	89	106	182	254	605	358	539	229	161	a 123
3	106	72	a 306	89	161	280	605	358	a 446	387	141	123
4	106	89	306	106	a 141	a 783	571	358	446	416	161	106
5	89	a 89	280	123	141	747	571	306	446	358	a 161	106
6	72	89	280	106	123	711	539	a 306	416	358	161	123
7	89	89	254	a 106	123	675	539	306	416	332	205	106
8	a 89	72	229	106	141	640	a 507	306	358	a 306	182	106
9	89	89	205	106	123	605	507	306	358	306	182	a 106
10	89	89	a 161	106	123	571	571	280	a 306	280	161	89
11	89	89	161	123	a 123	a 476	605	280	306	254	161	89
12	89	a 89	161	141	123	476	640	280	280	254	a 161	89
13	89	89	141	141	123	446	640	a 254	280	229	161	72
14	89	89	123	a 161	106	416	640	254	254	205	161	89
15	a 89	89	141	161	106	358	a 675	254	254	a 161	141	72
16	89	89	123	161	123	387	675	229	254	161	123	a 72
17	89	89	a 123	254	123	476	675	205	a 306	182	161	72
18	89	72	123	280	a 141	a 254	640	205	306	182	161	55
19	72	a 89	106	306	141	254	605	182	306	182	a 161	55
20	89	89	123	306	161	254	605	a 161	280	205	161	72
21	72	89	123	a 332	182	229	571	161	280	229	141	55
22	a 89	89	161	358	507	229	a 539	161	254	a 254	161	55
23	89	72	229	358	476	229	539	141	229	254	141	a 106
24	89	72	a 254	416	358	205	539	141	a 205	280	141	106
25	106	55	254	358	a 332	a 205	507	123	182	254	123	89
26	89	a 72	254	332	332	229	476	123	182	229	a 123	89
27	89	72	229	306	306	229	476	a 123	161	205	123	72
28	72	72	229	a 280	306	605	416	358	161	182	141	55
29	a 89	72	205	280	......	640	a 416	675	161	a 161	141	55
30	89	89	182	254	......	640	358	675	161	161	123	a 41
31	89	......	a 161	229	......	605	......	605	......	182	123	......

g River at West Warren, Mass., for 1904–1907—Continued.

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
55	254	141	539	141	106	476
55	229	[a] 141	539	161	123	476
41	205	141	476	[a] 161	[a] 123	476
55	[a] 205	123	476	123	123	446
55	182	123	476	123	123	446
55	182	123	[a] 416	141	123	446
[a] 89	161	123	416	141	89	[a] 416
89	141	106	306	123	89	416
72	123	[a] 123	254	106	89	416
141	123	123	254	[a] 106	[a] 72	416
161	[a] 106	141	254	106	72	446
161	229	123	280	123	123	416
141	205	106	[a] 306	123	306	446
[a] 141	205	123	123	123	306	[a] 446
141	182	123	123	106	358	675
123	205	[a] 141	476	106	476	571
123	205	141	539	[a] 123	[a] 476	476
106	[a] 229	141	476	123	476	476
106	229	123	476	123	476	416
106	205	123	[a] 416	141	416	416
[a] 416	161	123	416	141	416	[a] 416
416	205	141	358	161	476	416
387	205	[a] 141	306	161	476	358
358	182	141	306	[a] 205	[a] 476	332
332	[a] 182	123	254	205	476	306
306	182	123	254	205	476	280
306	161	123	[a] 229	123	476	280
[a] 280	161	123	229	106	476	[a] 254
280	161	123	161	....	416	254
254	161	[a] 123	141	....	416	254
[a] 254	....	476	141	....	[a] 476	....

[a] Gage read about 4 p. m.

mean for the day but are obtained by means of a weir formula a. m., except as noted on Sundays. The readings were taken ration and were not an index to the mean daily discharge.

AT WEST BRIMFIELD, MASS.

ay bridge just west of the West Brimfield station d, about 3 miles below West Warren.

.

909, to September 30, 1915.

ertical staff on upstream side of right abutment of ubsequently, a water-stage recorder at the downed to gage datum by a hook gage inside the well;

from the bridge or by wading.

owlders, gravel, and alluvial deposits; two chantically permanent.

um open-water stage recorded: 4.9 feet, March 1, et. Minimum stage recorded: 1.4 feet, September ond-feet.

affected by ice. (See Pl. IX, *A*, p. 119.)

ills at West Warren causes diurnal fluctuation in this reason it has not been possible to compute rge prior to the installation of the automatic gage.

efined; discharge record since the installation of l good.

Discharge measurements of Quaboag River at West Brimfield, Mass., during 1909–1915.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
1909.		*Feet.*	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 23	D. M. Wood	2.26	113	Nov. 15	C. S. De Golyer	2.40	157
23	.....do	2.15	95.0	16	.....do	2.53	177
Oct. 12	.....do	2.28	117				
				1913.			
1910.				Jan. 9	C. S. De Golyer	2.88	327
Feb. 17	D. M. Wood	[a] 2.81	316	Feb. 13	R. S. Barnes	[a] 3.43	183
17	.....do	[a] 3.02	353	Mar. 28	O. W. Hartwell	3.73	847
Mar. 2	T. W. Norcross	4.71	1,480	Aug. 9	C. H. Pierce	1.64	15.9
2	.....do	4.68	1,470				
6	.....do	4.17	1,110	1914.			
6	.....do	4.17	1,100	Jan. 5	R. S. Barnes	[a] 2.51	180
10	D. M. Wood	4.00	908	16	.....do	[a] 2.56	153
23	.....do	2.85	222	26	.....do	[a] 3.95	287
23	.....do	3.18	406	Feb. 12	.....do	[a] 2.84	193
23	.....do	3.11	389	28	Pierce and Barnes	[a] 3.20	155
July 11	R. C. Rice	2.30	125	Mar. 1	.....do	[a] 3.05	182
16	H. B. Alvord	1.70	[b] 16.0	Apr. 2	C. H. Pierce	3.73	839
16	.....do	2.35	136	Aug. 18	.....do	2.25	95.0
Sept. 11	W. G. Hoyt	1.97	64.6	19	.....do	1.87	28.8
				Dec. 3	R. S. Barnes	1.80	27.3
1911.				21	.....do	[a] 2.27	62.0
Mar. 7	C. S. De Golyer	2.45	191				
				1915.			
1912.				Jan. 4	R. S. Barnes	[a] 2.63	39.4
Feb. 9	Canfield and McMillan	[a] 3.59	97.4	6	.....do	[a] 2.06	31.9
Aug. 19	G. H. Canfield	1.62	11.8	Feb. 6	.....do	3.00	341
26	.....do	1.92	42.3	Mar. 5	.....do	3.12	464
26	.....do	2.39	142	Aug. 14	Hardin Thweatt	2.55	194

[a] Discharge relation affected by ice.
[b] Partly estimated.

NOTE.—Since Aug. 26, 1912, gage heights refer to the hook gage.

Discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for 1909–1912.

Day.	August.				Day.	August.			
	A. M.		P. M.			A. M.		P. M.	
	Time.	Dis-charge.	Time.	Dis-charge.		Time.	Dis-charge.	Time.	Dis-charge.
1909.					1909.				
23	....	....	4.00	75	28	8.00	12	5.10	59
24	8.00	11	5.00	127					
25	8.00	11	5.10	120	29	8.00	11	5.45	54
					30	8.00	39	5.10	127
26	8.00	11	5.30	127	31	8.15	18	5.00	89
27	8.00	11	5.10	131					

iver at West Brimfield, Mass., for 1909–1912—Con.

September.			October.			
. M.	P. M.		A. M.		P. M.	
Discharge.	Time	Discharge.	Time.	Discharge.	Time.	Discharge.
20	5.10	71	8.00	6	5.00	109
22	5.00	89	8.00	6	5.10	22
22	5.05	54	8.00	39	5.00	71
22	5.00	105	8.20	131	5.00	138
14	5.00	71	8.15	6	4.45	71
33	5.20	217	8.10	6	4.45	165
39	4.50	120	8.15	18	5.00	131
11	5.10	109	8.10	12	5.10	109
11	5.10	71	8.25	18	5.05	20
11	5.15	54	8.00	33	5.00	156
6	5.10	18	8.00	51	5.20	156
18	5.00	39	8.30	13	5.10	156
81	5.10	120	8.00	17	5.00	127
11	5.20	71	8.30	20	4.45	113
6	5.00	131	8.00	7	5.10	120
6	5.10	99	8.00	10	5.00	20
11	5.00	131	8.00	11	5.00	39
11	5.10	39	8.20	22	5.10	127
22	5.15	39	8.10	8	5.10	120
54	5.00	131	8.00	7	5.10	113
6	5.20	131	8.00	6	5.00	120
11	5.00	89	7.55	12	5.00	120
6	5.10	89	8.20	11	5.20	54
6	4.55	120	8.00	20	5.00	71
12	5.00	39	8.00	80	5.10	127
22	5.00	33	8.10	8	4.45	151
59	5.00	109	7.45	11	5.00	127
71	5.15	156	8.00	11	5.10	109
224	5.10	252	8.20	6	5.00	120
191	5.00	156	8.00	7	5.00	39
....	....	....	8.00	7	5.00	12

November.			December.			
7	5.20	156	7.55	11	4.45	57
11	5.10	120	7.50	33	4.40	93
6	5.05	127	8.00	11	4.45	109
7	5.00	120	7.50	8	5.05	51
11	5.10	113	8.00	11	5.00	18
7	4.45	18	8.15	54	5.00	99
6	5.00	39	8.00	11	5.10	109
156	5.00	131	8.10	8	4.45	120
6	5.10	109	8.20	14	5.00	156
6	5.05	156	8.30	18	4.45	156
54	5.15	109	8.15	27	4.45	54
6	5.10	54	8.00	27	5.00	71
7	4.40	18	8.00	89	5.00	156
11	5.00	18	....	....	....	....
131	5.00	131	....	....	....	....
18	5.00	109	....	....	....	....
7	5.00	54	....	....	....	....
7	5.00	89	....	....	....	....
6	4.50	80	....	....	....	....
6	4.50	57	....	....	....	....
6	5.00	18	....	....	....	....
18	5.00	89	....	....	....	....
7	5.00	89	....	....	....	....
6	4.45	80	....	....	....	....
2.5	5.00	71	....	....	....	....
62	5.00	89	....	....	....	....
18	5.00	89	....	....	....	....
11	5.00	18	....	....	....	....
89	5.00	131	....	....	....	....
22	4.45	99	....	....	....	....
....	....	....	....	....	....	....

Discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for 1909–1912—Con.

Day.	March.				April.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1910.								
1	8.15	1,660			9.00	371	6.00	335
2			5.00	1,410	8.30	348	5.30	252
3	8.15	1,320	5.15	1,340	8.00	252	5.00	252
4	9.15	1,260	5.30	1,260	9.10	313	5.15	245
5	8.30	1,180	5.00	1,140	8.30	380	6.00	217
6	9.20	1,060		1,040	8.30	380	6.00	217
7	8.30	1,200	5.00	1,180	8.15	380	6.00	185
8	8.00	1,140	5.30	1,080	7.25	179	4.00	231
9	8.30	1,060	5.00	1,020	8.30	252	6.00	185
10	9.00	945	5.30	896	8.00	131	5.30	131
11	9.00	875	5.15	726	8.50	245	6.00	185
12	8.00	805	4.45	770	9.00	335	6.00	272
13	8.00	645	4.50	645	9.00	353	6.15	217
14	8.30	705	5.10	574	8.15	335	4.45	201
15	8.10	585	5.15	520	8.00	283	5.00	185
16	8.45	530	5.15	530	8.00	245	6.15	156
17	8.40	480	5.20	585	8.00	156	5.00	252
18	8.45	530	5.10	480	8.45	291	3.40	191
19	8.30	480	5.20	395	9.00	272	6.00	291
20	8.00	380	4.30	380	9.00	430	5.15	268
21	9.15	455	5.00	430	6.15	245	5.30	245
22	9.15	470	5.10	371	9.00	326	5.30	217
23	8.00	335	4.30	380	9.00	335	5.45	211
24	9.00	400	6.00	353			5.00	191
25	8.45	390	5.15	335	9.00	335	4.45	185
26	9.00	390	4.45	291	8.45	335	6.00	326
27	8.00	417	4.30	317	9.00	430	6.00	380
28	8.00	380	5.15	326	9.00	390	6.10	291
29	8.45	390	5.35	291	9.00	480	6.00	185
30	9.00	371	5.00	335	8.45	380	5.30	217
31	9.00	380	6.10	313				
	May.				June.			
1	9.00	380	4.00	272	8.30	335	4.30	156
2	9.15	430	5.30	217	8.30	291	5.10	162
3	8.45	348	6.00	231	8.45	252	5.15	131
4	8.45	335	5.45	217	8.30	335	5.00	14
5	9.00	335	5.30	245	8.15	89	4.15	109
6	9.15	380	5.45	228	8.20	136	4.45	162
7	6.45	217	6.00	185	8.20	291	4.45	156
8	8.30	185	5.45	185	8.00	120	4.45	156
9	9.15	283	6.00	252	7.45	113	4.00	162
10	8.45	291	5.00	201	8.00	120	4.15	162
11	9.00	272	5.20	207	8.20	201	4.00	185
12	8.30	291	5.30	217	8.00	185	4.30	201
13	8.30	335	5.17	201	9.00	348	4.15	185
14	9.00	283	5.30	156	8.40	211	4.30	179
15	8.45	170	4.30	185	8.35	211	4.00	201
16	8.45	291	5.00	185	8.45	430	4.30	217
17	8.45	326	5.00	211	8.00	211	5.00	371
18	8.50	291	2.35	89	8.10	201	4.30	127
19			4.45	179	8.00	131	5.00	144
20	9.00	304	7.30	156	8.10	162	5.30	144
21	10.30	201	6.45	170	8.20	272	6.30	131
22	9.00	185	7.55	201	8.30	291	5.15	179
23	9.00	245	4.25	162	8.20	283	4.30	156
24	9.15	264	7.45	201	8.15	283	4.40	156
25	9.00	252	4.35	162	8.15	260	4.30	11
26	8.00	156	4.30	162	8.00	89	4.00	105
27	7.45	136	4.25	170	8.00	120	5.30	131
28	7.40	131	4.00	156	8.10	11	4.20	120
29	9.00	162	4.15	162	7.40	7	4.15	120
30	9.15	99	5.30	89	7.45	10	4.30	109
31	8.40	89	5.05	136				

River at West Brimfield, Mass., for 1909–1912--Con.

July.				August.			
A. M.		P. M.		A. M.		P. M.	
e.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
05	80	4.30	113	8.30	120	5.30	211
15	260	5.30	14	9.00	131	5.40	185
15	54	4.15	54	9.00	17	5.30	113
05	71	....	....	9.15	0	5.30	99
10	54	4.30	89	9.00	14	5.15	109
00	29	5.30	89	8.15	17	4.30	27
15	29	5.00	89	8.00	33	4.30	39
15	29	4.30	89	8.00	51	4.40	127
20	22	4.00	144	8.00	11	4.50	156
00	18	4.30	18	8.00	11	5.30	272
20	37	....	109	8.25	37	5.30	109
15	27	5.30	71	8.20	42	5.45	109
00	156	5.40	156	8.20	39	5.00	109
00	11	5.30	156	8.00	54	4.30	54
00	14	4.30	22	9.30	217	5.00	109
50	17	4.00	14	8.30	18	5.20	109
00	18	6.00	39	8.15	14	4.30	109
00	39	6.20	109	8.15	12	5.00	109
10	14	4.40	105	8.15	14	5.10	109
40	14	4.15	109	9.30	131	5.10	14
15	14	4.30	120	8.00	14	4.00	18
15	17	4.30	105	9.00	109	5.30	89
20	14	4.30	14	8.30	14	5.15	99
15	27	4.00	33	8.20	12	5.00	89
30	50	4.30	120	8.30	14	5.30	54
40	18	5.00	105	8.15	11	5.30	54
00	2	4.40	109	8.20	11	6.00	6
40	17	4.30	105	8.00	14	5.00	46
40	14	4.40	99	8.40	170	5.00	11
00	10	4.30	27	8.45	156	5.35	46
00	54	6.00	75	8.15	11	6.00	54
September.				October.			
50	46	6.00	99	8.40	7.0	5.00	8.5
10	22	5.30	54	8.30	8.5	4.30	11
45	22	5.30	22	9.10	131	5.00	54
00	39	3.00	54	8.35	7.0	5.25	54
30	71	4.00	71	8.50	12	5.30	54
15	54	5.30	109	8.30	11	5.20	54
15	25	5.30	131	8.30	11	5.40	54
20	14	5.30	109	8.30	11	5.00	11
50	25	5.30	109	8.45	11	4.30	11
25	18	5.00	18	8.30	11	4.45	54
00	54	5.00	54	9.00	20	5.00	89
15	54	2.50	109	8.45	7.0	5.30	109
00	6.0	5.15	89	9.00	8.5	5.30	89
15	7.0	5.30	89	8.40	7.0	5.30	89
00	8.0	5.00	89	8.30	8.5	5.00	22
30	11	5.30	99	8.30	27	4.00	27
20	11	5.00	2.5	8.30	27	5.15	71
00	2.5	5.00	2.5	8.20	14	3.50	22
00	75	5.10	89	8.30	17	5.20	71
30	11	5.30	109	8.25	14	5.00	39
30	11	5.30	109	8.30	17	5.30	71
00	11	5.00	75	8.25	14	5.00	12
40	12	5.30	109	8.20	14	5.00	14
45	11	5.40	18	8.30	17	5.30	71
30	27	5.00	27	8.30	8.5	5.45	62
30	27	5.30	109	8.25	8.5	5.45	62
40	18	5.30	89	8.25	7.0	5.45	68
30	11	5.30	89	8.45	11	4.40	27
25	7.0	5.40	80	9.00	12	5.00	22
30	7.0	5.25	54	9.00	22	4.40	22
...	....	....	....	8.35	25	4.40	27

Discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for 1909–1912—**Con.**

Day.	November.				December.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1910.								
1	9.10	14	5.00	54	8.30	14	3.00	61
2	8.50	14	5.00	54	8.20	12	4.30	54
3	8.50	17	4.40	71	8.30	14	5.00	22
4	8.30	14	5.00	71	8.00	22	4.20	22
5	8.50	14	4.00	39	8.40	27	4.30	39
6	8.00	39	4.00	46	8.30	17	3.30	89
7	8.40	54	4.50	109	8.40	14	4.30	54
8	8.50	22	4.40	120	8.30	18	4.40	46
9	8.30	7.5	4.30	127	8.45	17	4.00	89
10	8.30	10	5.00	120	8.30	14	4.00	14
11	8.30	25	4.30	120	8.20	17	4.30	18
12	8.40	22	4.00	37	8.30	22	3.30	71
13	8.00	39	4.00	39				
14	8.40	46	4.45	109				
15	8.30	25	4.40	120				
16	8.30	14	4.25	109				
17	8.30	11	4.40	109				
18	8.30	10	4.35	105				
19	8.45	14	4.40	14				
20	9.00	17	4.00	17				
21	9.15	156	4.20	89				
22	8.40	17	4.30	89				
23	8.30	14	4.00	62				
24	8.30	10	4.10	99				
25	9.15	156	4.30	89				
26	9.00	39	4.10	14				
27	8.20	11	4.15	11				
28	8.30	14	4.20	71				
29	8.20	14	4.25	75				
30	8.40	14	4.25	75				
31								
	March.				April.			
1911.								
1					9.00	480	5.00	272
2					8.45	272	4.00	291
3					9.00	430	4.40	430
4					9.00	530	4.50	455
5					9.00	597	5.00	480
6					8.40	574	5.00	480
7					9.00	585	5.10	470
8					9.10	585	4.30	252
9					9.00	272	5.00	272
10					8.45	390	5.00	470
11					8.00	366	5.00	455
12					9.00	430	4.40	455
13					8.45	480	4.30	470
14					9.00	480	5.00	455
15					9.00	480	5.00	335
16					8.45	335	4.45	344
17					9.00	380	5.50	335
18					8.50	380	4.00	380
19					8.45	358	5.35	313
20					9.00	480	5.15	335
21					9.00	585	5.30	380
22					8.30	470	6.00	291
23					9.30	291	4.00	313
24					9.00	480	4.00	380
25					9.10	480	4.50	335
26					9.00	390	5.00	335
27					8.30	234	5.00	335
28					8.40	234	4.50	335
29					9.00	234	5.00	217
30					8.00	234	3.30	245
31								

iver at West Brimfield, Mass., for 1909-1912—Con.

May.			June.			
M.	P. M.		A. M.		P. M.	
Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
252	4.50	234	9.00	27	4.00	54
245	5.00	224	8.45	22	4.30	46
252	4.45	217	8.40	18	6.30	39
252	6.00	234	9.00	17	5.00	46
217	5.30	185	8.55	18	4.00	75
201	5.00	156	8.45	27	5.00	109
156	4.50	170	8.40	25	5.00	105
170	5.00	185	8.45	27	5.40	109
201	5.00	151	8.35	27	5.00	105
211	6.00	131	8.30	29	5.00	131
217	6.00	131	9.30	156	6.30	54
211	5.15	131	9.00	33	5.00	109
201	4.50	89	9.15	25	4.50	99
105	4.00	109	9.00	22	6.00	109
185	4.40	99	8.50	22	5.50	109
165	4.50	105	9.00	20	5.00	99
185	4.00	105	8.50	20	4.00	14
179	5.00	100	8.30	18	5.00	46
201	4.40	109	9.00	54	5.15	89
217	4.00	37	8.40	20	5.00	109
42	4.55	185	8.50	18	4.50	105
217	5.00	151	8.50	18	4.10	109
245	4.40	144	9.00	17	5.15	99
217	4.45	131	8.55	20	4.10	22
211	4.50	131	9.10	25	4.00	29
234	5.00	136	8.40	20	4.40	27
217	5.00	85	8.45	22	4.10	109
89	4.50	105	9.00	22	4.15	109
39	4.30	80	9.10	18	4.15	105
42	4.00	89	9.00	17	4.30	109
27	4.40	80	....	....	....	....
July.			August.			
18	12.40	99	9.00	11	5.00	51
25	6.00	27	8.45	14	5.00	46
27	4.40	109	8.45	11	4.50	46
27	5.00	27	8.50	12	5.10	54
25	4.40	105	8.45	11	5.30	14
25	5.10	105	9.00	14	4.00	18
27	5.00	109	10.00	39	5.00	99
25	4.50	22	9.00	11	4.40	99
6.0	3.00	6.0	9.00	10	4.00	109
11	5.00	131	8.45	8.5	5.00	109
14	6.00	131	8.50	6.0	5.10	105
11	6.00	131	9.00	7.0	5.00	6.0
10	4.00	127	9.00	8.5	4.00	8.5
11	6.00	131	9.10	10	5.30	89
8.5	5.00	6.0	9.00	6.0	....	....
7.5	4.00	8.5	9.00	7.0	6.30	99
8.5	5.00	33	8.45	6.0	5.00	99
10	5.00	27	8.30	6.0	4.40	105
54	4.45	27	9.00	8.5	4.00	6.0
8.5	5.00	33	9.15	8.5	4.00	10
8.5	4.50	33	9.00	10	4.00	54
6.0	4.00	11	9.00	6.0	5.00	62
11	4.40	14	8.45	7.0	4.50	54
17	5.00	33	8.50	6.0	5.00	51
20	5.00	39	8.45	8.5	5.15	54
18	4.45	51	9.00	7.0	4.00	10
18	5.00	46	9.00	8.5	4.10	10
14	5.10	54	8.40	11	5.00	54
8.5	4.00	11	8.40	37	5.00	109
17	6.10	89	9.00	39	4.45	109
14	6.00	89	8.45	54	5.00	99

Discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for 1909–1912—Con.

Day.	September.				October.			
	A. M.		P. M.		A. M.		P. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
1911.								
1	9.00	75	4.00	113	10.00	120	4.50	131
2	8.35	71	5.10	71	9.00	144	5.00	136
3	9.30	71	5.00	75	9.10	185	5.00	156
4	8.30	89	4.50	131	9.00	179	4.40	156
5	9.00	54	5.30	131	9.00	170	5.30	162
6	8.40	46	5.00	136	8.55	170	5.00	156
7	9.10	51	6.00	144	9.00	185	4.30	105
8	9.00	54	5.10	109	9.30	109	6.00	109
9	9.00	39	4.30	39	9.00	120	5.00	109
10	8.35	46	5.40	51	9.10	185	5.00	109
11	8.50	54	6.00	99	8.40	170	4.50	113
12	9.00	39	5.00	109	9.00	165	4.35	105
13	9.00	131	5.10	113	9.30	185	4.00	109
14	9.00	185	5.00	109	9.00	179	4.00	109
15	9.00	185	4.50	109	9.00	127	4.00	131
16	8.45	185	5.10	156	8.50	326	4.10	109
17	8.50	156	4.00	170	9.00	335	4.00	131
18	9.00	185	4.00	156	9.10	348	5.00	144
19	9.10	131	4.30	109	8.50	335	4.50	185
20	9.15	131	4.50	99	8.45	380	5.10	191
21	9.00	109	4.30	109	9.00	358	5.00	217
22	8.40	22	5.00	113	8.55	217	4.00	234
23	8.30	20	5.00	27	9.00	252	4.10	217
24	9.30	37	4.50	39	9.00	358	5.10	217
25	9.10	156	5.30	131	8.50	335	5.00	211
26	8.40	29	5.00	127	8.45	335	4.30	201
27	8.45	27	5.00	109	9.00	344	4.30	201
28	9.00	33	5.10	113	9.00	313	5.00	217
29	9.00	37	5.00	131	10.00	234	4.10	228
30	8.50	39	4.40	42	9.00	234	5.30	185
31	......	......	......	......	9.00	217	5.15	191
	November.				December.			
1	9.00	211	4.50	170	9.00	335	4.10	353
2	8.50	201	4.45	162	9.00	335	3.55	109
3	9.00	185	5.00	156	9.00	127	4.00	185
4	8.50	185	4.30	109	8.45	313	4.50	380
5	10.00	185	5.00	201	9.00	313	5.00	291
6	9.00	211	4.50	185	9.00	313	4.00	272
7	8.55	195	3.30	211	8.45	291	4.10	252
8	8.10	185	5.30	201	8.50	291	4.15	252
9	8.45	191	5.00	207	9.00	291	4.30	185
10	8.30	185	4.50	201	9.00	185	5.00	211
11	9.00	179	5.00	109	8.50	291	4.40	291
12	10.00	120	3.00	127	9.00	283	4.50	283
13	10.00	179	5.00	191	9.00	291	5.00	272
14	8.10	185	4.50	211	8.40	313	4.35	272
15	9.00	201	4.35	201	8.50	326	4.40	291
16	8.50	185	5.00	201	8.50	335	4.30	252
17	8.40	211	5.00	217	9.00	335	4.00	390
18	8.55	224	4.30	211	8.45	335	4.30	380
19	9.00	211	4.25	211	8.30	291	5.00	362
20	8.50	217	4.40	217	9.10	300	5.10	390
21	9.00	217	4.00	224	9.00	313	4.30	380
22	10.00	335	4.00	252	9.00	335	4.30	380
23	9.45	371	4.40	245	8.50	313	4.00	313
24	9.00	291	4.10	260	10.00	335	4.20	335
25	9.00	313	4.00	335	9.00	358	5.00	291
26	10.00	335	3.30	358	8.45	335	4.00	380
27	9.00	335	5.00	335	8.45	326	4.10	390
28	8.50	326	4.50	390	9.10	313	4.00	390
29	8.50	313	5.00	358	9.00	326	4.35	362
30	8.55	355	5.10	380	9.00	291	4.00	283
31	......	......	......	......	9.10	291	4.10	313

iver at West Brimfield, Mass., for 1909–1912—Con.

January.				March.			
. M.		P. M.		A. M.		P. M.	
	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.
	380	4.30	390	......	......	......	......
	380	4.10	430	......	......	......	......
	585	4.15	430	......	......	......	......
	585	5.00	455	......	......	......	......
	770	5.00	520	......	......	......	......
	910	4.00	530	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......
......	......	......	......	......	......	4.20	......
......	......	......	......	9.10	2,250	3.50	2,050
......	......	......	......	9.00	1,950	......	......
......	......	......	......	8.00	1,180	4.00	1,140
......	......	......	......	9.00	1,140	4.30	1,120
......	......	......	......	9.30	1,100	4.00	1,060
......	......	......	......	9.00	1,060	3.45	980
......	......	......	......	8.30	910	4.00	840
......	......	......	......	9.15	840	4.30	770
......	......	......	......	9.00	705	5.00	705
......	......	......	......	8.55	675	4.00	657
......	......	......	......	9.00	645	4.10	645
......	......	......	......	9.45	645	4.30	645
......	......	......	......	9.00	615	5.00	585
......	......	......	......	9.30	585	5.10	585
......	......	......	......	8.50	585	4.45	603
......	......	......	......	9.00	910	5.50	1,060
......	......	......	......	8.50	980	5.00	910
......	......	......	......	10.00	910	4.30	910
April.				May.			
0	910	4.50	910	9.10	470	6.30	455
0	910	5.00	910	9.00	455	6.00	440
0	910	4.10	910	8.50	440	5.00	430
0	910	4.30	910	10.00	430	6.10	430
0	910	5.00	910	9.00	440	6.00	430
0	910	4.50	875	8.50	440	6.30	430
0	875	5.00	875	8.00	430	5.50	430
0	854	4.40	840	8.30	430	5.30	420
5	840	5.00	840	8.30	420	6.15	405
0	840	4.10	854	8.45	420	6.30	420
0	854	5.00	840	9.10	430	5.30	380
0	826	5.30	805	10.00	405	5.30	405
0	770	5.00	770	8.30	430	5.00	430
0	757	5.00	738	8.30	420	6.00	430
0	705	4.35	705	8.45	430	6.10	430
0	675	4.50	675	9.00	420	6.00	420
0	705	4.10	705	8.00	455	5.00	440
0	738	5.10	738	9.00	430	4.50	430
0	770	5.40	826	9.00	430	6.00	430
0	805	4.50	805	8.30	440	5.55	430
0	770	4.00	770	8.50	420	6.00	405
0	770	4.10	757	8.30	430	6.10	430
0	738	5.50	738	9.00	430	5.00	440
0	738	6.00	705	8.00	430	......	......
5	693	5.00	675	8.30	455	6.00	380
0	645	5.10	615	9.00	380	5.30	405
0	558	5.00	505	9.30	455	5.50	430
0	505	5.50	505	8.30	405	6.00	405
0	505	5.10	505	8.50	405	5.30	380
0	490	5.30	490	9.00	390	4.50	380
0	480	6.00	480	9.00	380	5.00	380

0

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Discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for 1909-1912—Co

Day.	June.				July.			
	A. M.		A. M.		A. M.		A. M.	
	Time.	Discharge.	Time.	Discharge.	Time.	Discharge.	Time.	Dis-charg
1912.								
1	9.00	380	5.30	380	7.00	39	6.30	21
2	9.00	405	5.00	371	7.00	27	5.30	10
3	9.30	430	4.30	335	7.05	27	5.25	13
4	8.00	380	4.40	335	7.30	27	7.15	17
5	7.45	283	6.30	291	7.00	39	5.35	12
6	8.30	430	6.45	217	7.05	18	6.00	1
7	8.15	252	6.20	245	9.00	22	7.30	
8	10.00	291	6.45	185	7.05	18	7.20	13
9	10.15	185	6.45	217	9.05	22	5.20	8
10	9.00	358	6.30	185	8.00	18	6.00	8
11	9.00	358	4.15	156	8.30	18	5.30	10
12	8.45	335	4.00	234	9.00	18	5.55	7
13	9.00	272	5.00	185	8.30	6	4.10	3
14	9.15	272	6.00	131	8.20	27	7.00	1
15	9.00	283	6.00	89	9.00	27	6.45	8
16	10.00	109	6.00	127	7.00	27	6.30	10
17	8.30	179	5.30	185	7.05	18	6.00	12
18	8.25	27	7.35	179	7.00	14	6.15	13
19	9.00	25	6.00	131	7.15	18	5.30	8
20	8.45	37	7.10	156	9.00	14	6.10	2
21	9.00	27	6.00	156	9.00	18	6.30	1
22	9.20	33	6.30	54	9.10	14	6.00	12
23	10.00	71	4.00	89	8.45	14	6.15	13
24	10.00	156	5.30	131	8.55	14	6.30	12
25	8.30	27	7.10	131	9.10	11	6.10	12
26	8.45	33	6.00	131	8.50	12	5.50	13
27	8.30	27	5.50	131	9.15	14	6.00	12
28	9.00	29	6.20	131	10.00	136	6.10	15
29	10.00	27	7.00	39	9.00	11	6.20	12
30	9.00	39	3.30	37	9.25	12	7.00	11
31	......	......	......	......	9.35	12	6.55	10
					August.			
1					9.00	11	6.00	10
2					8.45	12	6.10	10
3					9.10	11	6.30	5
4					9.15	71	6.40	10
5					9.15	109	5.30	11
6					9.00	12	6.00	10
7					9.00	14	6.10	10
8					8.45	11	6.55	11
9					9.20	17	6.10	10
10					9.00	17	6.00	2
11					10.30	39	6.30	5
12					9.30	62	6.15	10
13					9.00	17	6.00	10
14					9.00	17	6.30	10
15					11.10	105	6.45	10
16					9.00	12	6.00	10
17					9.30	12	6.15	3
18					10.00	46	4.30	5
19					9.00	59	6.00	10
20					9.00	12	6.10	10
21					9.00	12	5.50	11
22					8.50	12	6.00	13
23					9.20	11	5.00	11
24					9.45	18	5.50	1
25					......	......	6.00	5
26					7.45	40	4.00	5
27					8.00	18	6.00	13
28					8.00	21	6.10	7
29					8.00	18	5.35	10
30					8.00	19	5.40	7
31					8.50	20	4.00	2

boag River at West Brimfield, Mass., for the years
Sept. 30, 1912–1915.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
274	270	414	855	412	330	56	50	37
250	230	415	729	389	307	56	32	69
279	300	291	779	359	272	58	28	52
251	280	352	732	342	252	24	62	48
233	220	334	704	309	223	31	39	43
268	180	311	664	290	196	37	41	40
226	160	209	603	241	179	68	44	31
336	148	275	558	226	180	59	34	68
250	138	301	523	206	173	47	29	53
316	132	288	501	174	152	59	26	43
291	125	334	529	154	145	61	49	43
332	120	347	737	158	131	39	40	41
299	117	317	783	150	132	40	34	29
354	116	407	823	148	110	77	36	24
337	116	465	823	144	99	55	35	55
279	117	468	962	138	111	61	23	38
270	118	431	1,010	146	91	57	17	39
281	122	429	941	140	85	60	51	38
265	126	414	856	143	80	41	52	45
281	132	438	756	120	85	35	46	30
281	138	451	741	116	77	71	44	33
271	145	411	704	138	79	50	44	76
268	155	419	651	199	105	61	46	64
285	170	416	599	364	74	59	11	60
284	185	413	544	333	64	56	49	59
251	250	515	502	310	71	41	37	53
274	325	782	471	296	61	28	34	38
248	375	853	467	302	45	62	35	48
234	......	904	470	393	52	59	40	71
249	......	910	450	366	82	59	63	50
241	......	920	......	347	......	53	70	......

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept,
270	176	733	575	163	91	58	61
270	1,110	777	537	157	157	59	67
293	1,040	756	513	151	169	81	59
293	1,080	723	513	160	118	85	37
293	1,030	709	598	154	113	73	44
293	1,010	654	682	160	136	65	43
270	914	675	640	146	148	47	44
230	831	682	614	133	136	69	47
176	750	770	607	118	118	53	34
176	633	743	588	98	166	73	28
176	594	736	549	98	160	63	25
160	531	682	562	87	160	69	32
160	477	633	715	75	160	55	14
160	433	627	668	89	128	43	49
145	407	601	627	89	113	61	44
145	423	682	607	85	113	61	49
145	450	627	568	101	115	61	38
130	455	607	549	87	108	61	37
130	407	588	507	73	61	87	40
130	375	575	477	75	87	69	31
118	355	575	444	58	81	94	55
118	370	549	423	118	87	91	35
118	340	507	380	73	81	77	49
105	320	501	340	101	83	103	46
105	275	495	340	81	89	85	16
94	360	562	320	85	58	73	38
94	423	614	297	89	75	65	18
94	627	594	262	55	73	63	79
....	668	601	242	125	67	58	101
....	682	620	214	85	73	58	91
....	689	....	183	....	73	73	......

Daily discharge, in second-feet, of Quaboag River at West Brimfield, Mass., for the y ending Sept. 30, 1912-1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Se
1914-15.												
1	65	13	52	33	284	620	128	136	113	75	94	
2	21	41	55	28	193	568	130	148	77	136	115	
3	44	37	49	18	262	477	125	148	85	133	142	
4	25	40	58	50	401	335	120	136	79	136	250	
5	49	21	55	63	562	455	151	133	58	118	423	
6	44	28	34	101	401	417	163	130	73	120	330	
7	37	25	71	1,000	396	380	176	123	98	94	302	
8	31	18	40	935	375	345	176	136	59	118	284	
9	27	43	46	763	375	306	190	145	63	254	288	
10	24	40	46	729	311	284	193	136	63	211	279	
11	16	38	37	661	320	258	207	120	52	190	254	
12	40	16	38	797	266	246	246	120	49	183	234	
13	50	14	50	970	284	218	242	113	32	166	250	
14	37	28	59	722	270	211	238	108	79	157	207	
15	34	25	73	581	391	204	226	85	58	151	193	
16	28	59	125	562	633	186	211	96	56	139	176	
17	29	56	142	525	562	186	207	120	56	110	157	
18	21	49	113	1,020	507	169	190	98	65	103	139	
19	67	41	79	709	483	163	183	87	55	113	123	
20	41	52	40	647	439	160	169	81	56	110	128	
21	38	47	197	581	412	151	166	89	85	105	101	
22	31	33	94	501	391	166	163	113	55	105	123	
23	32	67	58	562	370	145	160	123	59	115	125	
24	34	68	44	661	401	136	151	125	52	91	113	
25	19	68	40	614	790	133	157	113	53	91	110	
26	30	68	35	555	756	128	160	110	44	103	110	
27	41	69	33	507	640	77	142	105	49	75	94	
28	40	61	31	461	661	120	148	89	77	71	81	
29	26	47	33	407	......	123	139	87	52	96	96	
30	26	67	30	302	......	115	142	103	49	98	103	
31	21	......	33	293	......	110	......	94	......	77	85	...

NOTE.—Discharge determined from a well-defined rating curve. Discharge relation affected by Feb. 6-28, 1913; Jan. 6 to Mar. 1, 1914; Dec. 11, 1914, to Jan. 20, 1915; and Jan. 31 to Feb. 17, 1915. I charge for these periods based on gage-height record, discharge measurements, and climatic data.

Monthly discharge of Quaboag River at West Brimfield, Mass., for the years ending Se 30, 1912-1915.

[Drainage area, 150 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Ac rac
	Maximum.	Minimum.	Mean.	Per square mile.		
1912.						
August 19-31	74	25	52	0.347	0.17	A.
September	81	15	44	.293	.33	A.
1912-13.						
October	78	18	37	.247	.28	A
November	140	38	70	.467	.52	A
December	304	44	113	.753	.87	A
January	354	226	276	1.84	2.12	A.
February	375	116	179	1.19	1.24	C.
March	920	209	459	3.06	3.53	A.
April	1,010	450	682	4.55	5.08	A.
May	412	116	244	1.63	1.88	A.
June	330	45	135	.900	1.00	A.
July	77	24	52.3	.349	.40	A.
August	70	11	40.0	.267	.31	A.
September	76	24	47.3	.315	.35	A.
The year	1,010	11	194	1.29	17.58	

West Brimfield, Mass., for the years ending Sept.
-1915—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
imum.	Minimum.	Mean.	Per square mile.		
265	33	90.8	0.605	0.70	A.
260	90	143	.953	1.06	A.
290	119	191	1.27	1.46	A.
391	73	147	.980	1.13	C.
293	94	175	1.17	1.22	D.
1,110	275	588	3.87	4.46	A.
777	495	640	4.27	4.76	A.
682	183	488	3.25	3.75	A.
163	55	106	.707	.79	A.
169	58	110	.733	.85	A.
103	43	68.8	.459	.53	A.
101	14	45.0	.300	.33	A.
1,110	14	233	1.55	21.04	
67	16	34.5	.230	.27	A.
69	13	42.6	.284	.32	A.
197	30	61.0	.407	.47	C.
1,020	18	528	3.52	4.06	C.
790	193	433	2.89	3.01	C.
620	77	245	1.63	1.88	A.
246	120	173	1.15	1.28	A.
148	81	115	.767	.88	A.
113	32	634	.423	.47	A.
254	71	124	.827	.95	A.
423	81	178	1.19	1.37	A.
101	37	72.3	.482	.54	A.
1,020	13	171	1.14	15.50	

boag River at West Brimfield, Mass., during the
g Sept. 30, 1913–1915.

cal ver of	Days of deficiency in discharge.		
	1912–13	1913–14	1914–15
3	6	3	7
6	52	19	47
8	125	51	102
1	157	88	145
4	184	120	175
2	200	158	216
0	222	196	246
7	241	245	278
4	253	264	293
1	285	279	307
5	314	290	322
2	341	323	346
9	354	358	361
	364	360	363
	365	365	365

al horsepower per foot fall that may be developed at different
days on which the discharge and corresponding horsepower
en in the columns for discharge and horsepower. In using
arious losses, the principal ones being the wheel loss, which
ss, which may be as large as 5 per cent.

WESTFIELD RIVER BASIN.

GENERAL FEATURES.

Westfield River rises near Savoy Center, in the town of Savoy at an elevation of 2,300 feet above sea level, flows southeasterl through the towns of Windsor, Plainfield, and Cummington to th village of Swift River, then southerly through Worthington, Chesterfield, and Huntington to the city of Huntington, whence its cours is southeasterly through Montgomery, Blandford, Russell, an Westfield to its confluence with the Connecticut at Springfield From its source to the gaging station at Knightville the distance i 30 miles. At Knightville the river is 500 feet above sea level and the drainage area comprises 162 square miles. At Russell th elevation is 280 feet and the drainage area is 332 square miles. A the gaging station near Westfield the elevation is 110 feet and th drainage area 496 square miles. The length of the river from Savo to its junction with the Connecticut is 55 miles, and the total drainag area is 515 square miles.

The principal tributaries of the Westfield are its Middle and Wes branches and Westfield Little River.

The Middle Branch of the Westfield heads among the hills of Peru about 2,200 feet above sea level, and flows southeasterly throug the towns of Middlefield, Worthington, and Chester to its junctio with the main stream, about half a mile below the gaging station a Goss Heights. The distance from the source of this branch to th gaging station is about 17 miles, and the drainage area comprises 53 square miles. At Goss Heights the river is 415 feet above sea level where it joins the main stream the elevation is 410 feet.

The West Branch of the Westfield rises in the town of Washington 1,900 feet above sea level, and flows southeasterly 22 miles through Becket and Chester to Huntington, where it joins the main river. The drainage area at this point is 96 square miles. At the gaging station in Chester the river is 600 feet above sea level, and the drainage area comprises 73 square miles.

Westfield Little River is formed in the town of Russell by the union of Borden and Pebble brooks. Pebble Brook, the continuation of the main stream, rises in Blandford about 1,560 feet above sea level. The stream flows southeasterly to a point a mile southeast of Cobble Mountain, then northeastward 2 miles, then again southeastward to Westfield, where it unites with Westfield River. West of West Parish the basin of this tributary is hilly. Eastward the valley is more open. At the gaging station in the town of Russell, 3 miles below the confluence of Pebble and Borden brooks, the drainage area comprises 48 square miles. The water of this stream is used by the city of Springfield for municipal supply.

Westfield is very hilly and toward the
Small tributaries are innumerable.
xy, and as there is but little storage
way into the main watercourses and
volume. Low water usually lasts from
of September. The spring rise comes
time a large proportion of the yearly

R AT KNIGHTVILLE, MASS.

highway bridge known locally as the Pitcher
rth of outlet of Norwich Lake and about 3 miles
anch of Westfield River.

09, to September 30, 1915.
n side of bridge.
rom bridge or by wading.
covered with bowlders and ledge rock; control

n open-water stage recorded: 8.9 feet, March 27,
00 second-feet. A gage height of 9.4 feet was
, 1910, but the channel was probably obstructed
stage recorded: 0.60 foot, August 10, 1913; dis-

ffected by ice.
ected by regulation.
l defined; open-water records good.

River at Knightville, Mass., during 1909–1915.

Dis-harge.	Date.	Made by—	Gage height.	Dis-charge.
Sec.-ft.	1912.		*Feet.*	*Sec.-ft.*
24.0	Feb. 7	Alexander McMillan....	[a] 1.95	105
27.7	Nov. 19	C. S. De Golyer........	2.13	250
37.3	19	.....do.................	2.13	247
	1913.			
,320	Feb. 14	C. S. De Golyer........	[a] 2.30	137
,120	Aug. 8	C. H. Pierce...........	.84	17.2
53.3				
614	1914.			
28.7	Aug. 14	C. H. Pierce...........	.99	23.9
	1915.			
101	Mar. 2	R. S. Barnes...........	2.62	447
873	Apr. 12	.....do.................	4.70	1,790
848				

rge relation affected by ice.

Daily discharge, in second-feet, of Westfield River at Knightville, Mass., for the years endin Sept. 30, 1909–1915.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1909.			1909.			1909.		
1	....	25	11	....	32	21	....	2
2	....	23	12	....	61	22	....	2
3	....	23	13	....	30	23	....	3
4	....	21	14	....	38	24	....	5
5	....	26	15	....	39	25	....	15
6	....	22	16	....	33	26	28	9
7	....	23	17	....	42	27	28	61
8	....	26	18	....	39	28	26	37
9	....	29	19	....	30	29	29	16
10	....	26	20	....	25	30	30	10
						31	37	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	88	48	55	....	255	1,920	1,120	310	445	101	46	8.0
2	80	48	55	....	238	1,440	985	238	373	84	37	22
3	77	67	53	....	238	1,310	920	201	272	71	32	20
4	74	74	53	....	255	1,380	730	183	238	63	41	79
5	73	60	55	....	207	1,990	495	201	201	60	61	330
6	76	60	53	....	176	1,780	420	174	920	61	55	350
7	58	48	74	....	153	1,570	395	141	550	63	38	670
8	45	48	77	....	148	1,850	395	238	420	46	37	373
9	55	48	71	....	....	1,180	350	445	350	37	34	125
10	67	48	76	....	....	1,440	350	350	470	37	42	77
11	74	60	77	....	....	1,240	291	255	1,310	39	74	63
12	82	60	66	....	....	1,050	272	291	790	46	54	42
13	74	60	77	....	....	920	272	255	420	41	48	33
14	60	60	238	....	....	730	238	272	350	38	46	39
15	59	60	272	....	....	670	238	610	272	37	41	35
16	47	60	....	....	....	640	238	310	291	37	38	37
17	48	82	....	....	....	550	238	222	445	34	28	35
18	56	82	....	....	....	373	350	201	495	32	30	25
19	54	74	....	....	....	350	670	179	373	32	53	23
20	54	74	....	....	....	373	373	192	291	33	46	21
21	58	60	....	....	....	1,180	310	174	238	33	37	19
22	82	60	....	5,130	....	1,050	272	207	183	32	23	20
23	82	60	....	2,880	....	985	255	183	148	41	23	16
24	58	60	....	2,280	....	1,050	238	174	129	37	22	16
25	58	58	....	1,500	....	1,710	238	183	125	33	25	35
26	82	55	....	1,180	....	1,920	2,280	207	108	32	26	44
27	76	54	....	1,180	....	1,310	1,640	189	110	32	13	37
28	76	54	....	855	2,130	1,440	1,380	198	108	28	16	35
29	61	55	....	670	....	1,310	790	174	108	30	14	39
30	60	58	....	470	....	1,240	445	207	104	38	14	39
31	48	....	....	330	....	1,120	....	445	....	49	13	....

eld River at Knightville, Mass., for the years ending *909–1915*—Continued.

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	445	420	84	53	35	112
....	330	730	70	48	28	94
....	580	523	68	44	25	77
....	640	470	80	39	23	74
....	730	445	116	28	20	63
....	1,180	395	204	25	19	68
....	1,920	222	855	32	19	58
....	1,240	222	790	30	18	73
....	790	192	445	28	17	95
....	640	238	174	28	17	108
....	550	207	179	27	16	141
....	470	169	189	27	16	116
....	550	204	1,640	25	15	94
....	730	183	920	23	14	66
....	985	158	395	25	14	56
....	670	153	272	23	108	84
....	670	131	134	33	82	74
....	580	104	108	58	63	68
....	580	94	99	55	58	64
....	640	207	90	53	52	59
....	580	166	85	50	41	53
....	523	143	79	30	26	55
....	470	127	76	26	22	50
610	373	104	68	40	20	143
523	350	106	71	53	32	134
580	291	121	84	58	53	143
373	495	121	88	52	77	53
920	550	108	87	55	114	66
238	445	94	85	60	420	84
610	445	74	60	53	291	114
580	....	67	....	46	129	....

Mar.	Apr.	May.	June.	July.	Aug.	Sept.
....	1,180	510	410	41	20	46
....	1,500	410	342	41	20	73
....	1,120	300	460	38	21	35
....	735	262	365	28	25	27
....	920	262	300	28	25	26
....	985	365	245	28	27	29
....	1,050	620	460	28	22	28
....	1,640	510	320	28	19	37
....	1,310	460	245	28	13	33
....	1,310	410	186	25	22	35
....	1,050	510	180	25	77	32
....	855	342	175	25	116	35
....	855	510	169	23	71	35
....	675	262	148	32	50	37
4,860	855	228	129	28	29	40
2,580	1,500	300	127	25	22	60
1,920	1,710	300	112	24	20	74
1,710	1,780	262	101	25	88	63
1,500	1,050	228	90	23	84	56
1,240	735	210	84	22	84	53
1,240	735	192	80	25	68	52
1,120	920	855	79	28	84	52
985	855	795	77	32	30	50
675	795	460	74	26	25	50
410	1,120	795	71	25	25	50
388	855	228	68	24	39	46
342	675	198	56	20	58	40
245	675	175	48	20	38	35
1,990	648	164	44	19	32	35
1,850	592	985	41	16	26	40
1,380	....	985	....	17	23	....

Daily discharge, in second-feet, of Westfield River at Knightville, Mass., for the years ending Sept. 30, 1909–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	39	148	164	735	795	735	1,050	280	186	25	19	17
2	37	592	198	1,050	245	510	675	210	180	24	14	19
3	42	435	1,180	855	262	342	538	198	143	20	14	16
4	42	228	565	1,120	262	262	510	192	143	20	16	14
5	42	180	320	460	210	245	1,180	180	136	22	18	22
6	32	134	855	320	195	210	795	169	97	19	16	63
7	28	166	675	620	177	204	592	164	103	14	12	50
8	28	1,570	410	1,440	165	175	460	139	95	16	7	37
9	28	920	280	855	158	410	435	129	82	19	8	23
10	28	985	300	485	151	565	365	125	85	19	4	18
11	32	280	320	538	146	410	460	112	87	13	7	16
12	58	280	280	1,440	142	388	1,850	108	77	12	10	13
13	61	245	153	675	138	510	1,310	103	74	23	16	11
14	50	795	198	460	137	1,380	1,180	101	67	23	14	11
15	48	648	175	410	135	1,920	920	103	55	20	22	10
16	35	460	228	388	135	1,120	675	139	48	19	26	10
17	37	365	228	920	134	620	565	180	48	16	17	9
18	26	300	204	1,180	134	538	460	134	39	15	14	12
19	30	245	485	920	135	435	460	121	39	20	12	15
20	32	228	460	485	135	1,120	388	108	60	17	12	16
21	26	228	320	920	137	985	342	94	90	19	13	25
22	35	210	192	538	140	795	365	101	71	18	16	300
23	90	201	201	410	142	620	342	245	60	16	16	320
24	2,130	195	201	538	145	675	280	1,120	50	15	15	116
25	1,120	565	204	388	148	735	280	485	41	15	13	80
26	675	365	210	320	153	1,920	262	280	41	13	12	61
27	388	280	410	342	160	3,440	245	210	42	20	12	39
28	210	228	410	300	920	1,990	300	290	41	26	13	30
29	210	175	365	245	....	1,240	538	1,050	35	49	22	26
30	195	198	365	300	....	855	388	460	25	44	44	23
31	141	....	1,240	280	....	1,440	....	280	....	32	33	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913-14.												
1	30	164	280	150	1,500	240	1,240	920	95	58	22	55
2	56	156	342	150	1,000	1,710	2,350	675	87	106	20	44
3	94	141	365	300	600	1,240	1,440	620	84	116	16	39
4	84	131	435	275	600	920	1,120	510	134	97	19	32
5	68	125	388	250	600	675	920	795	226	68	24	31
6	50	125	300	200	500	565	920	1,310	139	80	20	24
7	37	121	920	250	400	435	1,120	735	94	108	22	19
8	38	125	795	200	250	388	1,310	648	84	121	20	20
9	37	1,570	510	200	200	365	2,280	538	77	112	17	17
10	39	1,710	365	200	150	320	1,440	485	71	88	12	14
11	38	855	342	100	125	300	1,310	410	68	84	13	16
12	74	510	300	150	75	280	1,440	460	60	77	41	20
13	121	410	280	100	60	300	1,380	1,780	55	74	39	17
14	87	388	320	150	100	320	1,180	920	45	58	28	14
15	70	320	342	200	150	280	1,050	675	37	48	25	13
16	52	320	280	200	200	365	1,050	538	66	35	17	17
17	48	300	262	200	200	563	920	460	60	30	14	14
18	38	280	245	175	200	735	1,310	410	53	46	17	14
19	33	280	198	150	250	485	1,710	365	48	35	30	14
20	74	565	180	125	250	435	1,710	300	63	32	52	14
21	280	410	210	150	250	365	1,570	245	63	32	58	13
22	101	320	210	125	250	320	1,180	245	48	30	300	13
23	71	280	207	100	200	320	920	228	46	33	94	12
24	71	245	280	125	200	320	735	207	48	28	58	12
25	320	245	300	600	150	320	675	166	39	28	53	14
26	1,310	228	280	1,000	150	648	1,240	180	39	26	25	14
27	1,310	228	204	1,200	125	2,130	1,440	172	32	25	25	12
28	538	228	153	1,200	150	3,840	1,120	151	42	25	25	12
29	365	342	200	1,200	....	1,780	985	125	48	22	226	11
30	280	320	180	1,200	....	1,240	1,120	118	63	26	245	12
31	210	....	170	1,500	....	1,050	....	108	....	23	84	....

ield River at Knightville, Mass., for the years ending
909–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
130	373	166	395	68	97	116	222
250	373	198	330	73	291	121	183
200	330	222	272	63	395	255	161
180	310	350	207	56	255	3,0'0	141
160	291	183	207	52	169	1,920	129
250	291	172	222	55	207	985	118
640	272	523	207	61	139	920	118
495	395	523	207	61	1,640	495	116
350	291	610	222	61	1,920	395	108
272	291	640	183	46	730	610	101
255	255	1,780	158	44	350	373	92
222	238	1,920	146	37	445	291	80
255	195	1,050	134	35	395	395	82
255	222	640	134	34	272	291	172
222	222	550	121	40	181	207	151
1,500	195	445	104	63	148	222	99
790	192	395	116	84	136	207	90
420	183	350	129	87	129	166	85
330	164	330	121	73	129	146	74
272	198	310	110	92	1,240	139	68
272	222	272	103	104	373	116	179
272	195	255	255	73	550	445	445
291	238	238	201	66	350	1,180	183
670	272	238	156	61	238	470	127
3,920	310	222	125	46	179	445	108
1,850	470	201	121	68	158	330	108
985	272	201	129	53	174	222	238
580	272	183	112	67	174	192	146
....	222	201	94	55	192	207	112
....	156	272	88	48	179	238	101
....	164	....	74	....	139	291	....

ly well defined rating curve. Discharge relation affected by
910; Dec. 3, 1910 to Mar. 23, 1911; Jan. 9 to Mar. 14, 1912; Feb.
. 21 to Dec. 2, 1914; Dec. 14, 1914 to Jan. 7, 1915; and Jan. 30 to
c. 29, 1913, to Mar. 1, 1914; Nov. 21 to Dec. 2, 1914; Dec. 14,
915, based on comparison with records at other stations in

at Knightville, Mass., for the years ending Sept. 30,
1909–1915.

ge area, 162 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
aximum.	Minimum.	Mean.	Per square mile.		
7	26	29.7	0.183	0.04	C.
610	21	75.1	.464	.52	B.
88	45	65.9	.407	.47	B.
82	48	59.8	.369	.41	B.
272	53	[a] 107	.660	.76	C.
5,130	....	[a] 573	3.54	4.08	C.
2,130	....	[a] 258	1.59	1.66	D.
1,990	350	1,200	7.41	8.54	B.
2,280	238	573	3.54	3.95	B.
610	141	245	1.51	1.74	B.
1,310	104	355	2.19	2.44	B.
101	28	44.4	.274	.32	C.
74	13	35.7	.220	.25	C.
670	8	90.2	.557	.62	B.
5,130	8	301	1.86	25.24	

Monthly discharge of Westfield River at Knightville, Mass., for the years ending Sept. 30, 1909–1915—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910–11.						
October	33	15	24.1	0.149	0.17	C.
November	855	19	141	.871	.97	B.
December			[a] 85.7	.529	.61	D.
January			[a] 201	1.24	1.43	D.
February			[a] 74.1	.457	.48	D.
March	920		[a] 259	1.60	1.84	C.
April	1,920	291	648	4.00	4.46	B.
May	730	67	216	1.33	1.53	B.
June	1,640	60	256	1.58	1.76	B.
July	60	23	39.6	.245	.28	C.
August	420	14	60.8	.375	.43	B.
September	143	50	84.6	.522	.58	B.
The year	1,920	14	174	1.07	14.54	
1911–12.						
October	2,720	90	462	2.85	3.29	B.
November	790	207	412	2.54	2.83	B.
December	1,310	134	390	2.41	2.78	B.
January			[a] 261	1.61	1.86	C.
February	675		[a] 272	1.68	1.81	C.
March	4,860	245	[a] 1,020	6.30	7.26	C.
April	1,780	592	1,020	6.30	7.03	B.
May	985	164	422	2.60	3.00	B.
June	460	41	176	1.09	1.22	B.
July	41	16	26.4	.163	.19	C.
August	116	13	42.0	.259	.30	B.
September	73	26	43.5	.269	.30	B.
The year	4,860	13	379	2.34	31.87	
1912–13.						
October	2,130	26	193	1.19	1.37	B.
November	1,570	134	395	2.44	2.72	B.
December	1,240	153	381	2.35	2.71	B.
January	1,440	245	643	3.97	4.58	B.
February	920	134	212	1.31	1.36	D.
March	3,440	175	864	5.33	6.14	C.
April	1,850	245	607	3.75	4.18	B.
May	1,120	94	245	1.51	1.74	B.
June	186	25	78.0	.482	.54	B.
July	49	12	20.7	.128	.15	C.
August	44	4	15.7	.097	.11	C.
September	320	9	47.4	.293	.33	B.
The year	3,440	4	310	1.91	25.93	
1913–14.						
October	1,310	30	194	1.20	1.38	B.
November	1,710	121	381	2.35	2.62	B.
December	920	153	317	1.96	2.26	B.
January	1,500	100	391	2.41	2.78	D.
February	1,500	60	317	1.96	2.04	D.
March	3,840	240	750	4.63	5.34	C.
April	2,350	675	1,270	7.84	8.75	C.
May	1,780	108	500	3.09	3.56	B.
June	226	32	70.5	.435	.49	B.
July	121	22	57.1	.352	.41	B.
August	300	12	53.6	.331	.38	B.
September	55	11	19.1	.118	.13	C.
The year	3,840	11	360	2.22	30.14	
1914–15.						
October	74	12	23.3	.144	.17	C.
November	169	17	54.4	.336	.37	B.
December	192	15	68.5	.423	.49	B.
January	1,990	50	365	2.25	2.59	B.
February	3,920	130	582	3.59	3.74	B.
March	470	156	260	1.60	1.84	A.
April	1,920	166	455	2.81	3.14	A.
May	395	74	167	1.03	1.19	A.
June	104	34	60.9	.376	.42	B.
July	1,920	97	386	2.38	2.74	A.
August	3,040	116	498	3.07	3.54	A.
September	445	68	138	.852	.95	A.
The year	3,920	12	253	1.56	21.18	

[a] Mean discharge estimated, on account of ice, by comparison with records of other stations.

tfield River at Knightville, Mass., during the years Sept. 30, 1910-1915.

Days of deficiency in discharge.				
910-11	1911-12	1912-13	1913-14	1914-15
....	....	5	....	....
2		29	20	15
18	5	58	30	28
56	47	84	53	44
76	64	101	77	53
84	74	114	89	63
215	105	137	134	128
262	123	173	161	177
283	159	201	184	218
305	211	244	235	291
315	248	272	273	319
341	298	310	292	338
355	321	327	311	348
361	335	339	321	352
363	353	356	351	355
365	363	364	364	363
....	365	365	365	365
....	366	....	....	....

cal horsepower per foot fall that may be developed at different f days on which the discharge and corresponding horsepower ven in the columns for discharge and horsepower. In using e various losses, the principal ones being the wheel loss, which loss which may be as large as 5 per cent.

RIVER AT RUSSELL, MASS.

e just west of the railroad station at Russell.

s.

4, to December 16, 1905.

n side of bridge.

e from the bridge or by wading.

posed of gravel and small bowlders; section rough; ol uncertain.

tage recorded: 9.3 feet, 6 p. m., September 4, 1905.

5 foot, 7 a. m., July 24, 1905.

n affected by ice; gage not read during winter

loped and discharge not determined. Gage heights y.

stfield River at Russell, Mass., during 1904-5.

Discharge.	Date.	Made by—	Gage height.	Discharge.
Sec.-ft.	1905.		*Feet.*	*Sec.-ft.*
4,990	Apr. 5	T. W. Norcross........	2.81	2,680
1,330	15	.....do..................	2.12	1,590
531	25	.....do..................	1.32	735
353	May 19	.....do..................	1.20	480
374	July 15	Barrows and Norcross..	.75	167
210				
224				
1,030				
249				
540				
196				

arge relation affected by ice.

Daily gage height, in feet, of Westfield River at Russell, Mass., for the years ending Sept. 30, 1904–1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1904.							1904.						
1	2.8	2.15	1.1	2.2	0.8	0.9	16	1.8	1.9	1.2	0.9	1.0	2.0
2	3.65	1.9	1.1	1.75	.9	.9	17	1.75	1.65	1.15	.9	.9	1.4
3	2.75	1.8	1.1	1.4	.85	.85	18	1.9	1.5	1.1	1.2	.9	1.2
4	2.2	1.7	1.05	1.2	.8	.8	19	2.0	1.85	1.05	1.05	.85	1.1
5	2.2	1.6	1.2	1.1	.8	.8	20	1.8	2.3	1.05	.9	1.2	1.05
6	2.45	1.55	1.6	1.4	.8	.8	21	1.7	1.75	1.0	.9	2.0	1.0
7	2.65	1.5	3.6	1.15	.7	.7	22	1.65	1.45	1.0	.7	1.3	1.0
8	2.7	1.4	2.15	1.0	.7	.8	23	1.65	1.35	1.0	.8	1.1	.95
9	3.2	1.5	4.15	.95	.8	.8	24	1.65	1.3	1.0	.9	1.0	1.0
10	3.3	1.7	2.45	.9	.8	.8	25	1.8	1.2	.95	1.0	.95	1.0
11	2.65	1.6	1.9	.95	2.55	.85	26	1.8	1.7	1.0	1.0	.9	1.05
12	2.4	1.45	1.65	.95	1.4	.8	27	1.85	1.5	.95	1.0	.9	1.0
13	2.2	1.3	1.45	1.05	1.1	.8	28	3.3	1.3	.95	1.0	.8	1.0
14	1.95	1.25	1.35	1.05	1.0	.8	29	3.5	1.2	1.0	.95	.8	1.0
15	1.8	1.2	1.3	.95	1.1	4.2	30	2.55	1.15	1.35	.9	.8	1.55
							31	......	1.15	......	.8	.8	......

Day.	Oct.	Nov.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1904–5.									
1	1.3	1.1	....	3.9	1.3	0.8	0.8	1.3	1.2
2	1.1	1.05	....	2.9	1.25	.8	.75	1.0	1.0
3	1.0	1.05	....	2.3	1.2	.85	.7	.9	4.4
4	.95	1.1	....	2.25	1.15	.8	.7	.8	6.5
5	.9	1.1	....	2.85	1.1	.8	.6	.8	3.05
6	.9	1.1	....	4.3	1.1	.85	.7	.6	2.0
7	.9	1.05	....	2.7	1.1	1.1	.7	.7	1.55
8	.85	1.0	....	2.3	1.1	1.05	.7	.85	1.4
9	.8	1.0	....	2.2	1.05	.9	.6	.8	1.2
10	.85	1.0	....	2.3	1.1	.85	.6	.7	1.1
11	.9	1.0	....	2.9	1.0	.8	.7	.7	1.1
12	1.0	1.0	....	3.05	1.1	.8	.95	1.1	2.3
13	1.15	.95	....	2.3	1.1	.9	.8	1.05	2.35
14	1.2	1.0	....	2.15	1.15	.9	.8	.9	1.55
15	1.1	1.05	....	2.1	1.25	.9	.6	.9	1.35
16	1.0	1.1	....	1.9	1.45	.9	.6	1.4	1.3
17	.95	1.05	....	1.8	1.4	.8	.6	1.5	1.3
18	.9	.95	....	1.65	1.3	.75	.6	1.1	1.4
19	.9	1.0	4.0	1.6	1.2	.7	.6	.9	1.75
20	.9	1.1	3.25	1.55	1.1	.95	.7	.8	1.4
21	3.4	1.25	2.25	1.8	1.0	.95	.6	.8	1.6
22	2.45	1.3	2.1	1.75	1.0	1.85	.6	.85	1.4
23	1.7	1.2	2.0	1.5	1.0	1.65	.6	.8	1.2
24	1.4	1.2	1.8	1.4	.95	1.15	.5	.85	1.1
25	1.3	1.15	3.1	1.35	.9	.95	.55	.8	1.1
26	1.2	1.05	3.5	1.3	.9	.9	.7	1.0	1.0
27	1.2	.95	4.4	1.3	.9	1.0	.65	.85	.9
28	1.2	....	3.95	1.35	.85	.9	.6	.85	.95
29	1.15	....	4.1	1.3	.8	.8	.6	.9	.9
30	1.1	....	4.45	1.3	.85	.8	2.2	.9	.85
31	1.1	....	4.5	....	.8	....	1.85	1.3	....

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1905.				1905.				1905.			
1	0.85	0.95	1.5	11	.8	1.1	1.6	21	1.7	1.4	......
2	.9	1.0	1.3	12	1.9	1.05	1.9	22	1.3	1.4	......
3	.9	.95	......	13	1.5	1.0	1.3	23	1.2	1.0	......
4	1.0	1.05	......	14	1.2	1.0	1.1	24	1.1	1.0	......
5	.95	1.1	......	15	1.1	.9	1.05	25	1.0	1.0	......
6	.9	1.1	......	16	1.1	1.0	1.25	26	1.0	1.0	......
7	.8	1.65	1.5	17	1.0	1.05	......	27	1.0	1.0	......
8	.85	1.4	1.55	18	.95	1.0	......	28	1.0	1.0	......
9	.8	1.25	1.4	19	1.1	1.0	......	29	.95	1.3	......
10	.8	1.1	1.4	20	1.8	1.4	......	30	1.0	2.95	......
								31	.95	......	......

NOTE.—Discharge relation affected by ice Nov. 28, 1904, to Mar. 20, 1905, and Dec. 17–31, 1905.

ER NEAR WESTFIELD, MASS.

as Trap Rock Crossing, about 3 miles east of
nouth of Westfield Little River. Great Brook
n.

, to September 30, 1915.
r on right bank; referred to gage datum by a hook
aff used for auxiliary readings.
from cable or by wading.
vel. Control at low and medium stages is about
permanent; at high stages probably the crest of
below station.
m stage recorded: 17.4 feet at 11.30 p. m. August
, determined from an extension of the rating
imum stage recorded: 3.02 feet, September 24,

affected by ice.
n Westfield Little River for municipal supply of
ersion is added in the table of monthly discharge
iver.
s above station cause some diurnal fluctuation of
ld.

ld River near Westfield, Mass., during 1914–15.

Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Sec.-ft.	1915.		*Feet.*	*Sec.-ft.*
184	Jan. 20	R. S. Barnes	7.34	2,950
165	20	.....do	7.12	2,670
117	21	.....do	5.59	1,360
122	22	.....do	4.99	1,040
67	Feb. 4	.....do	a 4.46	566
182	Apr. 11	.....do	7.94	3,620
	13	.....do	6.94	2,540
	15	.....do	5.54	1,270
393	Aug. 16	Hardin Thweatt	4.28	573
6,810				

ge relation affected by ice.

Vestfield River near Westfield, Mass., for the years
g Sept. 30, 1914–15.

Sept.	Day.	June.	July.	Aug.	Sept.
	1914.				
300	16		164	232	60
200	17		152	144	80
175	18		208	119	75
125	19		136	133	75
115	20		126	204	70
112	21		122	300	70
84	22		140	300	65
80	23		160	1,000	70
80	24		264	500	77
75	25		192	300	77
70	26		160	200	70
75	27	212	176	150	77
80	28	180	192	125	77
75	29	216	192	100	64
70	30	228	156	500	64
	31		129	600	

Daily discharge, in second-feet, of Westfield River near Westfield, Mass., for the year ending Sept. 30, 1914-15—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1914-15.												
1	61	188	352	340	372	1,260	505	1,300	352	328	268	66
2	61	94	216	260	690	1,080	510	1,020	376	280	296	52
3	64	84	336	220	605	960	535	900	252	780	475	47
4	80	108	296	180	530	750	530	780	228	660	4,500	42
5	84	101	320	160	475	810	620	690	200	515	7,550	32
6	67	160	228	140	630	840	840	690	105	610	2,500	32
7	67	140	244	1,790	1,550	780	1,220	600	168	490	1,910	38
8	84	152	304	990	1,220	840	1,190	630	248	870	1,400	32
9	70	84	192	430	840	810	1,300	750	208	8,200	1,020	32
10	70	70	212	212	660	750	1,470	636	184	2,030	1,120	31
11	80	70	200	188	510	720	3,660	550	176	1,120	900	30
12	70	70	208	336	520	690	5,440	510	168	1,080	720	28
13	87	80	204	2,030	545	605	2,500	420	144	1,160	810	27
14	98	136	304	1,080	505	636	1,670	410	136	810	840	31
15	87	77	276	690	720	648	1,330	390	204	625	666	29
16	101	340	240	480	4,140	600	1,190	348	204	520	605	32
17	148	550	180	455	2,160	607	1,080	415	200	440	595	319
18	140	385	180	2,300	1,360	614	990	415	348	364	525	310
19	212	348	184	6,000	1,020	621	930	425	368	405	465	301
20	260	224	108	3,100	930	628	900	415	308	900	420	29
21	248	129	144	1,510	900	634	810	332	364	750	368	28
22	248	184	200	960	930	640	750	540	405	750	520	27
23	133	208	108	720	1,020	647	720	750	272	810	1,870	26
24	119	208	88	1,550	1,710	654	684	620	248	540	1,050	25
25	112	160	49	1,220	14,500	750	654	520	129	420	900	24
26	129	220	46	960	5,040	930	642	485	140	435	900	23
27	94	200	43	780	2,210	648	600	445	196	372	654	33
28	91	224	40	720	1,590	580	570	445	208	376	545	37
29	108	284	40	590	....	615	565	405	228	440	485	32
30	115	336	430	455	....	500	810	292	192	385	636	28
31	126	....	405	360	....	475	....	188	....	356	900	....

NOTE.—Discharge determined from a well-defined rating curve. Discharge relation affected by ice Dec 16, 1914, to Jan. 18, 1915, and Feb. 1-14, 1915; estimates based on gage heights, discharge measurements, and climatic records. Discharge estimated Aug. 22 to Sept. 5, Sept. 8-22, 1914; Mar. 17-23 and Sept. 17-25, 1915; by comparison with records at other stations in Westfield River basin.

Monthly discharge of Westfield River near Westfield, Mass., for the years ending Sept. 30, 1914-15.

[Drainage area, 496 square miles.]

Month.	Observed discharge in second-feet.			Diversion from Westfield Little River, in million gallons.	Total discharge in second-feet.		Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.		Mean.	Per square mile.		
1914.								
July	495	122	209	368.4	227	0.458	0.53	B.
August	1,000	100	229	345.3	246	.496	.57	B.
September	300	60	92.9	359.9	111	.224	.25	C.
1914-15.								
October	260	61	113	341.0	130	.262	.30	B.
November	550	70	187	311.8	203	.409	.46	B.
December	352	40	206	341.7	223	.449	.52	C.
January	6,000	140	1,010	327.4	1,030	2.08	2.40	C.
February	14,500	372	1,710	282.9	1,730	3.49	3.63	C.
March	1,260	475	720	325.2	736	1.48	1.71	A.
April	5,440	505	1,170	319.6	1,190	2.40	2.68	A.
May	1,300	188	559	324.6	576	1.16	1.34	A.
June	405	105	232	337.1	250	.504	.56	B.
July	8,200	280	897	344.9	914	1.84	2.12	A.
August	7,550	268	1,170	324.6	1,190	2.40	2.77	A.
September	660	236	332	328.7	349	.704	.79	A.
The year.	14,500	40	687	3,910	704	1.42	19.28	

NOTE.—The effect of storage in Borden Brook reservoir not taken into account in computing the total discharge.

FIELD RIVER AT GOSS HEIGHTS, MASS.

r bridge in Goss Heights, about 1½ miles above the
ialf mile above the mouth of the Middle Branch.

, to September 30, 1915.
r 7, 1912, chain attached to upstream side of the
September 30, 1915, Barrett & Lawrence water-
utment on right bank; water-stage recorder is
s of a hook gage inside the well; an outside staff
gs.
from the bridge or by wading.
coarse gravel and bowlders; control practically

m stage recorded: 7.33 feet, July 8, 1915; approxi-
et. Minimum stage recorded: 0.70 foot, 6. p. m.
r 27, 1914; discharge practically zero.
affected by ice.
cted by operation of a small power plant about

ter-stage recorder was installed.

Branch of Westfield River at Goss Heights, Mass.,
uring 1910–1915.

Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Sec.-ft.	1913.		*Feet.*	*Sec.-ft.*
8.6	Feb. 14	R. S. Barnes	a1.84	46.7
3.7	Mar. 26	O. W. Hartwell	3.64	1,140
114	Aug. 8	C. H. Pierce	.92	3.4
57.7	Sept. 6	.....do	1.09	12.4
5.1	6	.....do	1.09	11.2
4.4	1914.			
	Jan. 2	R. S. Barnes	a1.62	45.1
27.2	12	.....do	a1.58	45.3
265	23	.....do	a1.99	33.8
	Feb. 10	.....do	a2.66	58
	26	.....do	a2.53	36.1
35.3	Apr. 3	C. H. Pierce	2.52	440
256	3	.....do	2.52	428
13.1	7	R. S. Barnes	2.00	221
12.7	May 25	.....do	1.37	52
6.8	Aug. 13	C. H. Pierce	.98	5.6
63.1	Dec. 16	R. S. Barnes	a1.40	51.3
59.4	1915.			
74.2	Jan. 8	R. S. Barnes	a2.86	116
66.2	Feb. 1	.....do	a1.79	62
243	Mar. 2	.....do	a1.94	116
	Apr. 12	.....do	2.92	657
208				
55				

narge relation affected by ice.

iddle Branch of Westfield River at Goss Heights, Mass.,
s ending Sept. 30, 1910–1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1910.				1910.			
	......	23	13	21	8.6	7.8	......
	......	23	11	22	10	5.2	......
	......	12	7.8	23	7.8	5.2	......
	5.2	11	6.9	24	6.9	8.6	......
	6.9	14	6.9	25	7.8	6.9	......
	8.6	10	6.9	26	5.2	4.4	7.8
	6.9	7.8	4.4	27	6.9	7.8	6.9
	7.8	7.8	5.2	28	8.6	8.6	13
	5.2	26	4.4	29	12	7.8	8.6
	7.8	29	4.4	30	10	7.8	4.4
				31	8.6	7.8	......

Daily discharge, in second-feet, of Middle Branch of Westfield River at Goss Heights, Mass., for the years ending Sept. 30, 1910–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1910–11.												
1.	6.9	6.9	21	......	......	......	152	135	66	14	11	42
2.	4.4	8.6	24	......	......	......	132	212	49	12	12	53
3.	......	48	29	......	......	......	110	170	30	10	13	29
4.	......	138	......	......	......	......	96	138	24	7.8	11	24
5.	......	322	......	......	......	......	110	113	21	6.9	10	16
6.	4.4	212	......	......	......	......	1,030	102	66	13	8.6	24
7.	10	68	......	......	......	......	860	83	336	12	7.8	18
8.	6.9	48	......	......	......	......	535	62	192	11	10	13
9.	7.8	42	......	......	......	......	300	71	91	7.8	8.6	16
10.	8.6	26	......	......	......	......	255	71	110	6.9	7.8	85
11.	6.9	59	......	......	......	......	238	68	75	5.2	5.2	91
12.	4.4	42	......	......	......	......	196	59	96	3.5	3.5	78
13.	6.9	40	......	......	......	......	221	66	435	11	......	75
14.	4.4	30	......	......	......	......	300	62	234	7.8	......	57
15.	6.9	30	......	......	......	......	585	59	135	13	......	46
16.	5.2	22	......	......	......	......	322	66	71	8.6	48	59
17.	6.9	24	......	......	......	......	221	42	66	10	16	48
18.	3.5	23	......	......	......	......	177	40	48	30	13	26
19.	......	32	......	......	......	......	177	91	40	14	11	22
20.	......	55	......	......	......	......	216	126	40	16	5.2	19
21.	......	68	......	......	......	......	189	102	36	12	6.9	16
22.	11	36	......	......	......	......	221	66	24	19	11	13
23.	14	30	......	......	......	......	212	55	30	16	13	24
24.	12	35	......	......	......	......	170	53	24	23	12	22
25.	13	26	......	......	......	......	142	53	24	21	12	14
26.	10	35	......	......	......	......	142	68	29	19	26	30
27.	6.9	29	......	......	......	1,270	132	49	42	16	46	30
28.	5.2	35	......	......	......	1,210	142	40	40	13	62	35
29.	11	46	......	......	......	585	177	42	36	21	85	30
30.	12	30	......	......	......	668	170	35	22	18	94	46
31.	13	......	......	......	......	255	......	30	......	13	75	......
1911–12.												
1.	53	119	104	138	......	......	435	181	48	6.9	7.8	7.8
2.	196	110	96	107	......	......	435	166	23	5.2	5.2	196
3.	181	96	102	94	......	......	750	138	300	4.4	12	132
4.	142	59	83	......	......	......	560	135	192	4.4	14	75
5.	135	55	83	......	......	......	485	107	48	3.5	12	30
6.	119	48	91	......	......	......	535	181	48	3.2	5.2	23
7.	166	278	104	......	......	......	585	212	42	3.2	5.2	21
8.	173	196	104	......	......	......	560	204	38	3.2	.5	20
9.	110	173	110	......	......	......	535	212	62	3.5	.5	20
10.	83	145	96	......	......	......	390	192	57	3.2	.4	8.9
11.	71	110	83	......	......	......	345	177	53	2.9	16	7.8
12.	59	83	80	......	......	......	300	135	46	3.5	7.8	8.4
13.	49	152	78	......	......	......	255	122	40	10	7.8	7.5
14.	36	138	78	......	......	300	246	113	36	16	7.8	7.5
15.	29	177	102	......	......	1,150	238	221	35	14	4.4	6.9
16.	24	177	156	......	......	1,690	234	204	30	11	3.5	13
17.	24	177	345	......	......	920	585	192	38	.5	3.2	15
18.	59	159	204	......	......	668	535	322	29	.5	2.9	10
19.	1,760	300	142	......	......	640	535	300	24	12	18	8.9
20.	560	216	96	......	......	585	390	234	23	10	16	8.6
21.	485	156	113	......	......	585	221	173	21	3.5	46	8.2
22.	980	142	107	......	......	560	196	345	21	12	23	6.9
23.	1,090	110	560	......	......	535	177	300	18	7.8	12	8.0
24.	920	126	322	......	......	435	156	212	14	5.2	23	7.9
25.	695	208	196	......	......	322	138	145	14	3.5	12	7.9
26.	189	145	142	......	......	216	126	122	12	3.5	12	8.0
27.	145	138	212	......	......	278	113	107	12	2.9	10	7.0
28.	75	113	208	......	......	159	142	83	11	.5	12	7.2
29.	83	102	177	......	......	668	135	71	11	.3	6.9	8.0
30.	75	96	152	......	......	640	181	57	7.8	.0	12	8.0
31.	83	......	142	......	......	485	......	53	......	3.5	11	......

e Branch of Westfield River at Goss Heights, Mass., Sept. 30, 1910–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	138	220	330	59	77	8.9	7.9	7.9
	70	175	204	47	67	8.9	6.9	7.4
	67	125	176	38	57	9.4	6.0	6.9
	64	85	161	39	55	7.4	5.2	6.4
	62	75	290	36	49	7.9	4.8	11
	59	70	221	33	36	6.4	4.0	11
	57	70	173	30	36	6.4	3.6	8.9
	54	60	143	24	38	6.4	3.2	7.9
	52	125	127	20	29	5.6	3.2	6.4
	49	175	109	30	23	5.6	2.9	6.0
4	47	140	361	33	23	5.2	2.6	5.6
4	44	120	892	30	21	5.6	2.3	6.0
1	42	130	436	29	19	4.8	1.6	5.2
9	39	456	384	29	18	4.8	3.2	2.9
7	38	599	260	26	15	4.4	4.8	3.2
9	38	388	406	36	15	4.4	3.6	3.2
8	38	176	167	41	13	4.4	2.9	3.6
8	39	127	149	39	12	4.4	3.6	4.0
4	40	112	135	36	13	4.0	2.0	4.0
8	42	204	122	27	17	4.0	2.0	4.4
4	44	260	107	26	24	3.6	2.0	6
0	48	473	102	30	19	3.6	2.0	75
4	52	124	97	72	15	3.6	2.6	59
0	57	194	92	286	12	3.6	2.9	27
7	65	201	82	310	11	3.2	3.2	17
4	80	605	77	87	11	2.9	2.0	12
0	106	1,470	77	67	11	2.9	2.6	8.9
7	485	672	80	104	12	5.6	2.3	8.9
70	....	322	109	290	7.9	19	5.6	8.9
72	....	252	82	149	7.9	12	7.4	8.4
5	....	274	....	102	....	11	7.9	....
51	530	80	426	256	23	6.4	2.9	5.6
38	314	1,040	905	204	21	12	4.4	4.8
99	221	667	451	182	21	16	4.4	3.2
87	211	294	314	164	26	11	4.4	3.2
80	201	201	256	314	40	8.4	4.4	3.2
57	114	135	221	476	30	6.4	4.0	2.0
80	119	131	256	294	21	11	3.6	2.6
53	90	127	599	228	22	23	3.2	1.0
57	55	117	1,220	204	21	11	2.9	1.4
57	49	97	503	173	20	7.4	3.2	1.4
27	39	122	426	155	14	6.4	3.6	1.2
45	20	107	530	204	12	6.4	4.4	1.2
38	19	92	426	678	11	6.4	4.8	.8
47	36	80	314	335	11	6.4	4.0	.6
61	55	67	314	238	11	6.4	3.6	.5
63	59	94	294	204	14	6.4	2.9	.5
63	61	140	357	173	12	6.4	2.6	.6
59	63	208	530	155	12	5.6	2.9	.5
49	75	149	647	141	11	4.8	2.9	.4
36	80	112	775	127	11	4.0	4.4	.
45	75	121	617	112	11	3.2	38	.5
36	75	130	357	104	8.9	6.9	47	.5
30	59	130	275	87	4.8	6.9	20	.5
38	55	112	221	78	4.8	2.9	11	.5
221	51	87	195	57	4.4	3.2	7.4	.6
335	45	117	426	42	2.6	2.9	5.6	1.2
426	38	736	503	38	2.9	2.7	2.9	1.4
402	59	695	370	40	4.4	2.6	3.6	1.4
335	....	653	310	30	6.9	2.6	4.0	1.4
402	....	339	335	28	8.9	2.6	8.9	2.0
580	....	298	....	26	....	2.9	8.4	....

Daily discharge, in second-feet, of Middle Branch of Westfield River at Goss Heights, Mass., for the years ending Sept. 30, 1910–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	2.3	2.0	14	12	45	138	35	102	7.4	23	18	43
2	2.3	4.0	16	12	61	124	30	87	5.6	51	13	30
3	2.0	2.6	18	12	53	99	35	82	5.2	65	26	27
4	2.0	2.3	15	12	67	84	38	75	4.8	38	1,180	24
5	2.0	2.6	11	12	77	97	38	65	4.0	30	646	23
6	2.0	2.9	8.9	17	143	82	61	61	2.6	38	256	15
7	2.0	3.6	9.4	65	260	72	127	53	3.6	19	208	12
8	2.0	2.0	11	114	173	84	130	61	3.6	919	149	13
9	2.0	4.4	10	38	117	75	158	70	3.2	886	87	13
10	2.3	3.6	8.4	23	77	61	179	51	2.6	176	84	13
11	2.6	2.0	5.6	12	57	59	570	38	2.3	80	57	12
12	2.6	3.6	7.4	41	63	53	710	33	2.0	135	39	9.4
13	2.6	2.6	7.9	338	67	50	256	32	1.2	117	61	11
14	2.6	2.9	51	238	57	45	173	30	1.2	61	47	6.4
15	2.6	2.6	55	221	221	47	135	24	1.4	41	38	3.6
16	3.6	41	29	238	576	41	117	23	2.9	35	35	3.6
17	12	35	23	335	294	38	107	24	4.8	32	32	4.4
18	17	19	15	879	204	33	102	27	6.0	30	24	4.4
19	17	14	12	840	161	30	92	23	4.0	26	23	4.0
20	17	11	12	416	143	33	82	19	5.6	112	19	6.0
21	11	7.9	23	256	135	36	75	14	6.4	35	19	33
22	7.4	7.4	33	218	130	32	59	53	3.2	67	127	38
23	6.9	6.9	35	221	143	35	47	49	2.9	38	173	12
24	6.9	7.4	20	286	388	45	43	36	2.6	30	80	7.4
25	5.2	10	12	218	1,810	65	39	26	2.3	33	72	5.2
26	1.4	17	12	182	530	102	38	24	2.0	24	53	6.0
27	.4	26	11	158	238	61	36	35	2.0	23	38	7.4
28	.6	51	12	135	158	47	35	23	9.4	23	35	7.9
29	1.4	41	23	107	....	38	35	12	6.9	26	35	6.0
30	2.0	29	23	80	....	30	75	9.4	6.0	26	80	6.4
31	2.6	....	14	57	....	38	....	8.9	....	18	77	....

NOTE.—Discharge determined from two fairly well defined rating curves—one applicable to the chain gage readings and the other to the hook gage.

Discharge relation affected by ice Dec. 4, 1910, to Mar. 26, 1911; Jan. 4 to Mar. 13, 1912; Feb. 3 to Mar. 12, 1913; Dec. 27, 1913, to Mar. 1, 1914; Nov. 19–27, 1914; Dec. 16, 1914, to Jan. 17, 1915; Jan. 30 to Feb. 15, 1915, and Feb. 27 to Mar. 12, 1915. Daily discharge Feb. 3 to Mar. 12, 1913; Dec. 27, 1913, to Mar. 1, 1914; Nov. 19–27, 1914; Dec. 16, 1914, to Jan. 17, 1915; Jan. 30 to Feb. 15, 1915; and Feb. 27 to Mar. 12, 1915, estimated from discharge measurements, climatic records, and information furnished by the observer. No record obtained Sept. 4–20, Sept. 22–24, and Nov. 7–14, 1912; discharge estimated by comparison with records at Knightville.

Monthly discharge of Middle Branch of Westfield River at Goss Heights, Mass., for the years ending Sept. 30, 1910–1915.

[Drainage area, 53 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910.						
July 14–31	12	5.2	7.82	0.148	0.10	B.
August	29	4.4	11.3	.213	.25	B.
September	196	.0	26.9	.508	.57	B.
1910–11.						
October	14	.0	6.71	.127	.15	B.
November	322	6.9	54.9	1.04	1.16	A.
December	....	....	[a] 30.0	.567	.65	D.
January	....	....	[a] 70.0	1.32	1.52	D.
February	....	....	[a] 25.0	.472	.49	D.
March	1,270	....	[a] 176	3.33	3.84	D.
April	1,030	96	264	4.98	5.56	B.
May	212	30	78.4	1.48	1.71	A.
June	435	21	84.4	1.59	1.77	A.
July	30	3.5	13.3	.251	.29	B.
August	94	.8	20.9	.394	.45	B.
September	91	13	36.7	.692	.77	B.
The year	1,270	.0	71.7	1.35	18.36	

[a] Estimates based on comparisons with records at other stations in Westfield River basin.

Westfield River at Goss Heights, Mass., for the years
30, 1910–1915—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
aximum.	Minimum.	Mean.	Per square mile.		
1,760	24	285	5.38	6.20	D.
300	48	144	2.72	3.04	D.
560	78	151	2.85	3.29	D.
....	....	[a]86.7	1.64	1.89	D.
....	....	[a]86.2	1.63	1.76	D.
1,690	....	[a]413	7.79	8.98	C.
750	113	351	6.62	7.39	B.
345	53	175	3.30	3.80	B.
300	7.8	45.1	.851	.95	B.
16	.0	5.28	.100	.12	B.
46	.4	10.6	.200	.23	B.
196	6.9	23.5	.443	.49	B.
1,690	.0	148	2.79	38.14	
500	7.0	51.6	.974	1.12	D.
600	43	129	2.43	2.71	C.
418	59	154	2.91	3.36	B.
519	65	183	3.45	3.98	B.
485	38	72.0	1.36	1.42	C.
1.470	60	264	4.98	5.74	C.
892	77	205	3.87	4.32	A.
310	20	71.1	1.34	1.54	A.
77	7.9	25.5	.481	.54	B.
19	2.9	6.13	.116	.13	C.
7.9	1.6	3.77	.071	.08	C.
75	2.9	11.8	.223	.25	B.
1,470	1.6	98.3	1.86	25.19	
762	7.9	74.5	1.41	1.63	B.
984	29	179	3.38	3.77	A.
339	55	139	2.62	3.02	A.
530	27	127	2.40	2.77	B.
530	19	102	1.92	2.00	B.
1,040	67	241	4.55	5.25	B.
1,220	195	446	8.42	9.39	A.
678	26	179	3.38	3.90	A.
40	2.6	14.1	.266	.30	B.
23	2.6	6.81	.129	.15	B.
47	2.6	7.43	.140	.16	B.
5.6	.4	1.51	.028	.03	C.
1,220	.4	126	2.38	32.37	
17	.4	4.72	.089	.10	B.
51	2.0	12.2	.230	.26	C.
55	5.6	18.0	.340	.39	C.
879	12	188	3.55	4.09	C.
1,810	45	230	4.34	4.52	C.
138	30	60.5	1.14	1.31	C.
710	30	122	2.30	2.57	A.
102	8.9	41.0	.774	.89	A.
9.4	1.2	3.92	.074	.08	B.
919	18	105	1.98	2.28	A.
1,180	13	124	2.34	2.70	A.
43	3.6	13.6	.257	.29	A.
1,810	.4	76.1	1.44	19.48	

s with records at other stations in Westfield River basin.

Days of deficiency in discharge of Middle Branch of Westfield River at Goss Heights, Mass., during the years ending Sept. 30, 1911–1915.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge.				
		1910–11	1911–12	1912–13	1913–14	1914–15
1.0	0.11	4	8	....	13	2
2.0	.23	6	8	1	22	7
3.0	.34	9	11	17	41	44
4.0	.46	12	24	32	52	54
5.0	.57	16	27	46	69	63
10	1.1	43	59	96	93	98
15	1.7	88	83	115	117	129
20	2.3	109	89	126	122	147
30	3.4	163	104	141	142	176
40	4.6	206	112	162	164	226
50	5.7	238	123	177	177	244
75	8.5	277	158	214	201	279
100	11.4	304	195	242	226	300
150	17.1	328	255	295	266	324
200	22.7	338	294	315	291	334
250	28.4	347	314	326	309	344
300	34.1	350	319	341	318	350
350	39.8	355	331	345	330	351
400	45.5	355	333	351	334	352
450	51.2	357	336	355	341	354
500	56.8	357	339	357	344	354
600	68.2	360	353	360	351	357
700	79.6	361	358	363	357	358
800	90.9	361	359	363	361	359
900	102	362	359	364	361	362
1,000	114	362	362	364	363	363
1,500	170	365	364	365	365	364
2,000	227	....	366	....	....	365

NOTE.—The above table gives the theoretical horsepower per foot fall that may be developed at different rates of discharge, and shows the number of days on which the discharge and corresponding horsepower were respectively less than the amounts given in the columns for discharge and horsepower. In using this table, allowance should be made for the various losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

WEST BRANCH OF WESTFIELD RIVER AT CHESTER, MASS.

LOCATION.—At steel highway bridge about 500 feet above the Boston & Albany Railroad bridge in the town of Chester and about 400 feet below mouth of Walker Brook.

DRAINAGE AREA.—73 square miles.

RECORDS AVAILABLE.—Station established September 30, 1915; several discharge measurements in period 1910 to 1915.

GAGE.—Chain gage attached to upstream side of bridge; read twice daily.

DISCHARGE MEASUREMENTS.—Made by wading just below mouth of Walker Brook or from upstream side of bridge.

CHANNEL AND CONTROL.—Channel covered with coarse gravel and bowlders. Riffle about 300 feet below the station forms the control.

WINTER FLOW.—Discharge relation affected by ice.

REGULATION.—Several small power plants on the main stream and Walker Brook above the station affect distribution of flow at low stages.

Branch of Westfield River during 1910–1915.

e by—	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
....	....	33.2
....	a 4.48	651
....	2.44	35.3

in bridge and later reduced to datum of present gage.

RIVER NEAR WESTFIELD, MASS.[1]

of the Springfield waterworks, in the town of
uence of Pebble and Borden brooks and about 3
ally (July, 1905, to December, 1909) a short dis-
Cobble Mountain.

at original site; 48 square miles at present site.
to December 31, 1909, at original site; March 1,
present site.

t the original site below Borden Brook (used
etermined by methods commonly employed at
From August, 1906, to September, 1907, a 30-foot
tance below the gage.[2]

ter flow determined from continuous record of
(crest length, 155.4 feet), for which coefficients
ments at Cornell University; low water flow, less
from continuous record of head on a 12-foot sharp-
tions, the crest being 2.55 feet below that of the
f Springfield is measured by a 54-inch Venturi
chart. Daily record corrected for storage in a
t 5 miles above station, but owing to the time
dam and the natural storage along the stream
represent exactly the natural flow of the stream

um discharge for 24 hours, 1909–1915: 1,490
Minimum discharge apparently zero at various
from the reservoir was equal to or greater than
am.

ed at station for municipal supply of Springfield
l.

ompiled under the direction of E. E. Lochridge,
ommissioners, Springfield, Mass.

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ss.

eter methods are compared in U. S. Geol. Survey Water-
164-168.

Discharge measurements of Westfield Little River near Westfield, Mass., during 1905–1909.

Date.		Made by—	Gage height.	Discharge.
1905.			*Feet.*	*Sec.-ft.*
July	14	Barrows and Norcross..	2.32	32.4
Aug.	10	Norcross and Lochridge	2.30	23.8
Sept.	8	.....do................	2.98	82
	27	T. W. Norcross.........	2.40	26.5
	28	.....do................	2.39	25.7
Oct.	13	.....do................	2.94	85
	14	.....do................	2.76	59
Nov.	9	Norcross and Lochridge	2.57	40.1
1906.				
Mar.	23	T. W. Norcross.........	a 2.61	38
Apr.	5	.....do................	4.21	449
	6	.....do................	4.64	594
	6	.....do................	4.53	587
	6	.....do................	4.50	565
	6	.....do................	4.44	555
	23	.....do................	3.31	162
	24	.....do................	3.21	135
June	22	F. E. Pressey..........	2.48	26.5
Aug.	9	.....do................	2.58	45.2
	10	.....do................	2.34	23.4
	10	.....do................	2.32	26.0
	10	.....do................	2.34	22.8
	10	G. M. Brett............	2.34	21.4
	10	F. E. Pressey..........	2.34	22.4
	10	G. M. Brett............	2.33	24.2
	10	Barrows and Pressey...	2.33	22.3
Sept.	18	F. E. Pressey..........	1.68	3.4
	18	.....do................	1.68	3.2
	19	.....do................	1.68	3.3
	19	.....do................	1.68	3.1
	19	.....do................	1.68	3.1
	19	.....do................	1.68	3.1
	19	.....do................	1.68	2.8
	19	.....do................	1.68	3.2
	19	.....do................	1.68	2.9
	19	.....do................	1.68	3.3
	24	.....do................	2.09	11.8
	25	.....do................	2.04	10.6
	25	.....do................	2.02	11.2
	25	.....do................	2.02	10.6
Oct.	21	.....do................	3.28	154
	22	.....do................	3.00	96
	22	.....do................	3.00	94
	22	.....do................	2.99	89
	22	.....do................	2.99	87
	22	.....do...............	2.98	88
	22	.....do................	2.93	81
	22	.....do................	2.92	77
	23	.....do................	2.76	63
	23	.....do................	2.75	61
	23	.....do................	2.72	56
	23	.....do................	2.71	56
	23	.....do................	2.72	59
	24	.....do................	2.60	43.6
1906.				
Oct.	24	F. E. Pressey..........	2.59	41.3
	24	.....do................	2.58	40.4
	24	.....do................	2.56	39.8
	24	.....do................	2.56	39.3
	24	.....do................	2.58	40.8
	25	.....do................	3.28	150
	25	.....do................	3.28	138
	25	.....do................	3.26	140
Nov.	23	Lee and James.........	3.02	93
	24	.....do................	2.84	72
1907.				
Apr.	24	Wood and Mention....	4.20	472
	27	.....do................	3.12	113
	27	.....do................	3.10	114
	27	.....do................	3.09	118
May	17	D. M. Wood............	3.76	309
	17	Barrows and Norcross..	3.71	278
July	19	.....do................	2.03	11.5
Aug.	22	T. W. Norcross.........	1.78	4.80
	22	.....do................	1.78	4.89
	22	.....do................	1.78	5.09
	22	.....do................	1.78	4.85
	22	.....do................	1.72	4.09
	22	.....do................	1.70	4.03
	23	.....do................	1.73	4.70
	23	.....do................	1.73	4.81
	23	.....do................	1.73	4.57
	23	.....do................	1.74	4.37
	23	.....do................	1.73	4.36
	23	.....do................	1.73	4.41
	23	.....do................	1.72	4.48
	23	.....do................	1.71	4.46
	23	.....do................	1.71	4.21
	23	.....do................	1.71	3.58
1908.				
Apr.	24	D. M. Wood............	2.85	60.4
	24	.....do................	2.85	76.7
Sept.	25	Wood and French.....	1.68	3.9
Oct.	19	.....do................	1.88	9.0
	19	.....do................	1.87	4.4
Dec.	21	.....do................	a 2.20	18.1
1909.				
Jan.	1	D. M. Wood............	a 2.40	21.8
	7	.....do................	a 3.54	221
	21	.....do................	a 2.61	22.7
Feb.	10	.....do................	a 3.53	86.9
	24	.....do................	4.61	618
Mar.	9	.....do................	2.71	53.6
Apr.	2	.....do................	3.52	226
June	2	.....do................	2.60	45.1
Aug.	25	.....do................	1.96	9.3
Oct.	9	T. W. Norcross.........	1.92	5.3

a Discharge relation affected by ice.

Daily discharge, in second-feet, of Westfield Little River near Westfield, Mass., for the years ending Sept. 30, 1905–1915.

Day.	Aug.	Sept.
1905.		
1	220	31.5
2	100	33.8
3	69.8	423
4	51.0	832
5	30.7	518
6	21.7	255
7	30.7	141
8	27.1	92.4
9	26.4	69.8
10	20.6	51.0
11	25.1	42.8
12	23.9	276
13	17.8	272
14	13.6	155
15	29.2	85.0
16	85.0	67.3
17	64.7	64.7
18	36.4	92.4
19	22.8	93.9
20	18.7	77.9
21	15.6	89.4
22	14.4	69.8
23	12.2	51.0
24	11.6	40.9
25	64.7	35.5
26	40.9	29.2
27	27.8	29.2
28	24.5	27.8
29	33.0	23.9
30	51.0	23.9
31	39.9	....

Little River near Westfield, Mass., for the years
905–1915—Continued.

ov.	Apr.	May.	June.	July.	Aug.	Sept.
5.1	339	76.5	85.0	92.4	27.8	5.8
5.1	203	69.8	61.1	48.9	21.7	4.8
3.3	147	90.9	49.9	35.5	16.0	8.0
8.7	147	79.3	40.0	93.9	25.8	8.7
0.9	339	71.1	41.9	46.8	19.6	7.3
1.0	563	68.5	88.0	29.9	16.0	5.8
2.3	272	79.3	73.8	23.9	14.4	4.8
1.0	180	69.8	58.7	19.6	69.8	4.4
1.9	196	97.0	46.8	16.9	42.8	4.1
8.1	538	121	57.6	17.8	23.9	3.9
2.2	745	92.4	58.7	17.8	22.8	3.6
0.7	545	76.5	36.4	15.6	17.8	4.6
9.2	364	61.1	27.1	12.6	15.2	5.2
9.2	300	48.9	20.6	10.9	11.6	4.4
5.5	1,060	29.2	16.4	9.8	10.6	3.7
3.0	706	19.6	33.0	8.7	9.8	3.1
1.5	322	17.3	83.6	16.9	8.0	3.1
9.9	244-	14.8	105	25.1	8.2	2.8
6.4	183	13.3	93.9	16.9	6.9	2.8
3.8	164	14.0	66.0	14.0	6.0	4.6
2.8	134	13.3	40.9	14.0	30.7	22.8
2.8	115	12.2	38.1	12.2	16.0	27.8
2.8	141	11.2	28.5	13.6	10.9	38.1
3.8	141	12.2	38.1	15.2	14.0	13.6
3.8	117	18.7	29.2	12.9	9.8	10.3
2.2	102	16.4	23.9	9.2	8.7	8.7
2.2	88.0	38.1	19.2	9.2	8.0	10.3
61	76.5	210	16.0	20.6	18.7	9.0
27	67.2	426	13.3	32.2	11.9	9.8
80	88.0	213	12.9	85.0	9.0	25.1
......	....	123	....	39.0	7.8	....

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
.8	37.1	173	66.0	66.0	34.7	5.8	3.0
.6	37.1	125	62.3	266	25.1	6.4	2.8
.8	61.6	107	56.5	412	21.1	5.7	7.6
.7	50.7	97.0	90.9	248	14.4	8.7	38.1
.6	40.4	105	83.6	244	12.9	6.8	32.2
.2	37.1	97.0	69.8	300	12.6	9.8	23.9
.0	35.0	89.4	85.0	203	11.6	8.2	14.8
.9	33.0	75.2	76.5	117	11.2	5.3	10.6
.3	31.0	75.2	77.9	83.6	10.6	6.6	9.5
.5	30.0	69.8	79.3	68.5	10.0	5.3	10.0
.8	28.0	79.3	85.0	66.0	19.2	5.3	33.0
.3	28.0	79.3	72.5	56.5	35.5	4.0	42.8
.2	35.0	98.5	57.6	52.0	32.2	4.9	16.4
.8	48.3	117	48.9	48.9	16.0	6.0	12.9
.3	136	193	43.8	47.8	11.9	5.0	10.3
.0	110	149	149	41.9	11.2	4.1	9.5
.7	136	170	336	36.4	10.6	9.2	10.0
.5	173	129	170	35.5	12.2	7.6	9.0
.3	180	119	115	89.4	9.8	4.7	10.3
.5	218	100	97.0	43.8	9.8	5.3	9.0
.7	177	89.4	68.5	35.5	19.2	5.7	8.2
.5	224	85.0	57.6	29.2	13.3	3.8	8.7
7.1	545	98.5	52.0	25.8	10.0	4.0	230
7.1	493	360	44.8	23.3	8.2	7.6	458
7.1	251	200	43.8	21.1	8.0	5.3	158
7.1	255	119	41.9	19.6	10.0	3.8	79.3
7.1	248	95.4	170	15.6	8.5	3.0	56.5
7.1	437	85.0	170	14.8	5.7	4.9	41.9
....	482	73.8	85.0	14.0	5.3	4.7	752
....	390	71.1	71.1	62.3	6.2	4.6	318
....	276	....	53.1	....	5.3	3.1	....

Daily discharge, in second-feet, of Westfield Little River near Westfield, Mass., for the ye ending Sept. 30, 1905–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1907-8.												
1	152	217	54.4	269	....	100	258	612	189	5.7	7.6	7
2	90.9	213	56.5	139	....	107	213	234	76.5	19.2	6.6	6
3	71.1	885	62.3	111	....	83.6	158	224	47.8	127	5.8	6
4	141	552	66.0	85	....	58.7	131	158	38.1	63.5	7.2	6
5	85.0	266	68.5	....	....	48.9	127	89.4	29.9	37.3	9.5	5
6	62.3	717	66.0	....	....	41.9	147	79.3	29.9	25.1	35.5	5
7	61.1	1,040	75.2	....	....	43.8	152	108	28.5	20.1	58.7	5
8	696	493	93.9	....	61.1	39.9	245	668	26.4	17.8	36.4	5
9	328	308	552	....	42.8	43.8	430	314	22.2	15.2	21.1	4
10	164	224	570	....	37.3	39.9	258	227	18.2	11.6	19.2	4
11	111	217	266	....	34.7	43.8	183	164	15.6	9.0	19.2	4
12	119	149	170	507	34.7	47.8	147	123	14.8	9.5	15.6	4
13	85.0	119	158	780	39.9	245	119	93.9	13.3	9.5	13.6	4
14	71.1	100	147	570	58.7	269	107	93.9	11.6	9.5	11.6	4
15	61.1	89.4	139	402	808	338	98.5	107	12.9	10.6	10.3	3
16	51.0	75.2	136	213	605	384	93.9	79.3	22.2	9.5	10.3	3
17	43.8	71.1	134	117	234	402	104	69.8	16.4	8.7	14.8	3
18	36.4	63.5	127	90.9	147	364	93.9	56.5	13.3	9.5	14.8	3
19	33.0	89.4	125	93.9	139	374	105	51.0	12.2	10.0	11.6	3
20	75.2	75.2	119	107	153	269	98.5	46.8	11.9	9.5	9.0	3
21	58.7	62.3	115	111	139	189	97.0	152	9.0	9.0	7.6	3.
22	47.8	89.4	113	107	123	158	90.9	448	9.5	10.6	11.2	3.
23	39.9	75.2	119	117	117	167	73.8	286	34.7	11.6	8.5	3.
24	36.4	68.5	647	....	111	563	73.8	170	45.8	8.5	7.6	3.
25	32.2	79.3	300	....	105	647	68.5	105	22.2	24.5	16.0	2.
26	29.2	71.1	176	....	104	668	66.0	55.3	14.0	25.1	9.2	3.
27	948	58.7	149	....	98.5	808	66.0	46.8	11.2	13.6	8.7	3.
28	1,590	55.3	149	....	95.4	885	69.8	39.9	9.0	12.2	8.2	3.
29	1,150	71.1	152	....	95.4	850	66.0	32.2	7.6	11.6	7.8	37.
30	692	55.3	370	....	....	458	69.8	29.9	7.0	10.3	7.0	13.
31	336	....	437	....	....	308	....	605	....	9.0	6.8	....
1908-9.												
1	10.3	14.8	9.0	19.3	19.7	149	254	440	51.0	7.6	2.6	4.
2	9.2	13.3	9.0	17.1	24.3	137	242	340	40.9	7.2	2.4	4.
3	8.2	11.9	8.5	14.8	18.4	125	230	238	29.9	6.4	2.3	4.
4	7.6	10.9	8.2	13.3	14.2	113	180	136	25.8	5.7	2.2	4.
5	6.2	10.6	8.0	340	27.2	101	196	115	36.4	5.7	17.3	4.
6	5.8	10.3	7.6	721	198	90	300	111	31.5	5.7	18.2	4.
7	5.7	10.0	69.8	218	113	78	406	100	29.9	6.0	15.2	3.
8	5.5	10.0	69.8	80.8	77.3	66	318	90.9	27.1	5.7	11.9	3.
9	5.3	9.5	83.6	61.5	55.0	54.4	248	68.5	23.3	7.6	8.5	3.
10	5.0	9.0	82.2	66.2	77.1	220	149	63.5	52.0	6.0	5.7	4.
11	10.9	8.7	76.5	52.5	204	149	105	58.7	43.8	6.4	5.0	10.
12	8.5	8.5	58.7	33.7	145	109	97.0	52.0	31.5	6.8	3.8	6.
13	6.4	8.2	52.0	28.4	119	85.0	89.4	51.0	28.5	6.0	3.3	4.
14	5.8	8.2	49.9	25.1	165	77.9	955	45.8	25.8	6.0	5.7	4.
15	5.7	10.6	98.5	74.0	147	67.3	1,380	38.1	22.2	6.4	4.7	4.
16	5.0	13.3	73.8	48.5	123	92.4	406	36.4	21.1	7.2	8.5	4.
17	4.9	12.6	58.7	30.5	162	55.3	283	34.7	23.3	14.0	22.2	6.
18	6.0	13.3	49.9	48.0	150	64.7	180	66.0	88.0	16.4	88.0	8.
19	6.0	13.3	40.0	63.0	92.6	44.8	105	56.5	58.7	10.6	43.8	5.
20	6.0	14.0	30.0	40.5	1,020	55.3	93.9	49.9	36.4	8.5	38.1	4.1
21	5.8	14.0	20.1	18.5	500	67.3	100	43.8	25.1	7.6	27.1	3.
22	5.7	13.3	18.7	17.2	536	55.3	180	75.2	22.2	7.6	15.2	3.
23	5.2	13.3	16.4	55.6	574	64.7	266	66.0	20.1	13.3	10.6	3.4
24	5.2	12.9	14.0	60.5	609	58.7	170	52.0	17.8	16.4	8.5	5.0
25	6.6	14.0	13.3	73.0	552	1,380	131	43.8	15.6	10.6	7.2	17.
26	31.5	16.4	12.6	62.0	342	668	97.0	40.9	12.6	9.2	6.6	38.1
27	39.9	15.6	12.2	50.4	227	378	75.2	164	10.6	8.0	6.0	33.0
28	23.3	13.3	11.2	43.4	161	360	189	136	9.5	7.2	5.7	28.5
29	19.6	10.6	10.0	35.8	....	290	115	196	8.5	5.7	5.7	25.1
30	17.3	9.5	9.2	30.9	....	278	189	131	8.0	4.4	5.3	23.
31	16.0	....	22.2	23.9	....	266	....	75.2	....	3.6	4.9	....

ld Little River near Westfield, Mass., for the
1905–1915—Continued.

b.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
...	....	....	....	98	8.1	14	....
...	....	....	....	70	....	18	....
...	....	....	....	59	37	13	12
...	....	....	....	51	16	9.4	5.1
...	....	....	....	32	20	18	25
...	....	....	....	161	8.3	22	27
...	....	....	....	161	22	....	20
...	....	....	....	94	....	.7	23
...	....	....	....	65	....	8.1	16
...	....	....	....	122	....	24	13
...	....	....	....	321	....	61	28
...	....	....	....	389	....	23	14
...	....	....	....	246	....	18	25
...	....	....	72	127	42	16	....
...	....	....	59	99	15	25	....
...	....	....	28	85	16	9.5	....
...	....	....	48	112	34	13	....
...	....	....	53	111	18	6.6	....
...	....	....	78	93	17	9.6	....
...	....	....	56	63	20	11	....
...	....	....	64	51	21	.8	....
...	....	....	61	35	20	2.6	....
...	....	....	57	29	15	6.6	2.0
...	....	....	52	27	4.7	4.7	6.7
...	....	....	46	27	4.6	3.4	....
...	....	....	46	24	4.6	....	....
...	....	....	45	24	.9	....	1.7
...	....	....	38	26	....	7.8	....
...	....	....	32	....	5.8	15	24
...	....	....	32	15	11	3.1	2.9
...	....	....	138	....	20	16	....
2	18	131	109	39	12	16	135
0	26	112	137	39	13	1.5	78
3	20	95	121	25	3.9	5.2	44
3	22	89	96	25	5.8	18	40
4	28	177	82	38	7.2	15	20
3	21	663	74	116	2	14	28
9	21	505	65	357	27	....	23
5	29	268	66	214	17	....	82
9	20	184	63	123	18	.9	237
7	20	170	56	75	.14	11	162
7	28	186	43	29	....	9.3	160
3.2	23	164	41	89	....	10	128
6.6	31	158	58	365	6.9	9.8	83
0	40	221	38	245	31	8.8	52
0	55	289	44	128	4.3	18	46
6	32	210	34	84	8.0	71	50
4	31	148	33	67	11	25	43
3	32	124	21	44	22	14	42
5	31	117	117	46	17	16	25
5	32	161	141	27	17	16	21
9	47	220	84	22	2.1	16	30
8	140	195	36	19	9.0	13	27
5	93	146	60	18	9.6	4.8	26
2	99	134	33	18	64	5.6	30
7	99	121	43	30	68	8.2	20
8	148	103	76	20	20	8.1	56
5	650	99	57	20	37	22	33
3	405	133	37	20	19	21	33
....	260	111	20	.82	19	137	55
....	223	115	29	38	14	110	83
....	169	....	17	....	7.9	115	....

Daily discharge, in second-feet, of Westfield Little River near Westfield, Mass., for years ending Sept. 30, 1905–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1911–12.												
1	104	103	101	96	105	162	392	164	286	12	6.2	1
2	270	118	83	66	94	167	538	119	142	9.6	8.5	4
3	158	79	79	58	97	134	626	96	114	10	10	5
4	150	76	78	51	104	123	305	84	85	3.9	7.3	3
5	139	93	68	97	92	120	251	81	67	......	8.7	2
6	94	66	64	52	110	121	377	187	60	......	7.0	3
7	144	195	66	61	96	119	605	193	62	......	5.5	2
8	128	139	45	52	96	122	489	152	55	......	6.1	1
9	89	113	55	70	101	156	278	159	43	3.3	8.1	1
10	67	85	47	73	91	154	211	155	35	3.0	6.1	
11	59	73	63	50	93	136	215	130	30	3.4	20	
12	43	80	75	46	78	140	182	110	27	2.9	8.0	
13	48	93	54	45	96	628	180	113	26	10	4.7	21
14	33	92	69	50	69	397	140	104	25	7.5	3.9	
15	42	167	67	72	47	693	133	105	22	2.0	......	......
16	30	136	174	73	56	1,310	250	277	20	2.9	6.6	1
17	38	116	226	70	49	923	240	353	20	3.0	7.2	1
18	665	188	165	46	44	855	275	217	19	4.8	20	2
19	1,280	310	123	81	46	913	288	127	19	9.7	26	
20	553	209	76	258	99	763	207	102	17	8.3	37	1
21	710	169	74	119	226	401	158	93	19	16	22	
22	806	129	140	99	325	194	139	98	21	25	1 6	1
23	636	124	352	79	266	134	165	80	14	16	17	
24	325	163	209	57	216	121	143	81	4.2	16	17	1
25	341	185	171	31	208	118	141	115	14	13	12	1
26	175	114	115	41	205	98	112	87	8.7	5.4	8.4	1
27	155	91	175	40	355	101	98	68	6.9	5.6	12	
28	128	92	138	98	280	130	95	49	9.2	......	8.6	19
29	107	113	105	96	216	557	94	54	13	......	8.3	1
30	101	128	102	122	......	555	168	463	11	......	15	
31	80	......	110	96	......	388	......	486	......	......	14	......
1912–13.												
1	6.9	50	52	316	90	155	175	95	65	3.2	2.3	
2	8.5	82	82	170	58	118	141	65	47	3.7	7.9	2
3	9.7	53	190	265	44	80	115	63	49	4.0	15	3
4	8.9	35	123	315	49	65	110	55	39	2.7	......	4
5	3.1	33	84	181	39	51	130	51	32	2.0	......	17
6	3.7	40	160	139	36	43	119	49	29	.7	1.1	13
7	7.0	193	155	157	39	40	108	47	32	......	2.4	......
8	......	364	110	504	43	40	95	32	38	......	2.1	......
9	1.4	188	70	368	38	48	69	26	30	......	5.4	......
10	3.0	133	72	203	34	101	63	26	23	......	.5	......
11	3.0	76	56	164	31	112	225	24	21	......	1.4	......
12	.9	78	59	243	33	154	469	25	19	......	3.0	......
13	.8	72	40	192	27	111	306	24	18	1.4	1.2	......
14	1.0	143	42	136	27	273	235	24	17	......	1.4	......
15	1.1	137	48	116	32	357	189	22	15	1.4	4.5	......
16	8.2	100	102	102	32	314	166	25	17	1.5	2.3	......
17	6.5	75	59	119	29	200	134	29	2.4	1.2	.3	......
18	5.9	64	45	154	24	137	102	26	5.8	15	2.6	
19	6.8	62	122	136	23	121	94	29	6.3	......	.8	14
20	1.6	55	110	112	23	187	78	23	22	.4	.6	14
21	1.1	42	80	142	51	224	66	29	19	1.8	.5	29
22	2.1	40	47	122	76	190	64	33	15	1.4	3.4	49
23	123	48	52	111	170	145	66	138	5.9	1.8	3.2	31
24	303	99	44	135	86	172	62	389	8.4	1.4	1.8	25
25	192	188	35	125	47	204	55	206	4.5	2.4	4.2	15
26	146	130	45	104	40	466	41	107	9.5	1.8	1.4	8
27	94	102	191	96	50	1,120	37	64	.1	2.3	1.6	2
28	72	66	183	76	120	524	156	217	20	12	1.0	1
29	44	59	120	47	......	279	167	485	14	5.1	27	7
30	45	40	461	61	......	226	120	241	......	4.0	7.0	8
31	41	......	521	67	......	208	......	112	......	3.4	4.1	......

eld Little River near Westfield, Mass., for the
), 1905-1915—Continued.

eb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
247	129	306	163	15	15	2.8	1.7
165	736	530	129	17	19	16	3.6
107	360	316	117	18	41	11	....
123	274	265	102	19	19	10	15
120	182	212	299	26	15	....	12
89	165	173	229	10	14	....	11
80	147	194	215	14	16	....	....
69	122	441	155	23	53	....	....
50	85	747	136	20	33	3.9	....
44	89	340	113	19	23	....	....
42	78	271	84	22	22	....	....
32	59	330	146	21	17	.03	1.2
54	65	323	373	6.0	5.0	.3	....
48	63	214	224	....	2.8	.4	....
65	62	195	152	4.3	7.1	18	.9
49	73	242	113	25	.4	12	3.5
60	142	370	99	20	6.7	....	2.0
60	177	411	79	19	10	....	2.3
55	128	369	70	20	17	2.0	2.5
43	98	453	60	20	13	3.0	1.2
38	81	450	57	10	....	17	2.2
34	66	292	43	4.2	1.5	15	2.3
33	69	214	42	2.4	7.6	14	2.2
29	63	147	35	.2	8.1	....	2.8
27	66	134	34	....	8.4	....	2.0
27	217	385	31	....	20	2.3	2.4
27	720	427	29	....	12	.8	....
27	1,490	257	25	5.0	....	.6	....
....	598	206	22	18	....	19	....
....	317	171	20	16	1.4	19	....
....	274	....	16	....	2.7	....	....
146	114	38	228	24	88	19	43
126	80	28	145	19	135	20	35
96	70	37	115	16	114	26	35
74	55	31	126	15	96	697	25
62	68	50	119	13	77	522	21
283	55	70	103	13	52	218	19
303	53	123	101	15	47	160	20
153	55	140	131	17	382	103	17
120	55	136	123	15	962	77	14
89	52	162	101	15	514	54	14
73	52	608	85	15	116	49	13
81	50	767	70	4.5	104	43	15
76	49	339	63	3.6	111	78	11
49	52	177	57	11	73	56	....
300	42	133	50	16	57	42	3.9
652	41	118	42	73	48	36	7
258	39	110	49	125	41	41	22
138	41	101	51	112	33	33	23
111	36	94	41	62	25	24	12
98	21	93	36	120	25	22	12
95	31	64	48	117	28	28	38
83	32	77	126	42	51	134	78
103	58	77	102	38	53	236	23
658	49	78	80	31	41	129	26
850	70	70	61	25	26	96	12
546	66	70	59	21	20	59	19
247	52	62	57	22	20	49	19
148	38	59	50	19	25	38	15
....	35	58	42	14	40	38	13
....	39	222	35	16	33	58	10
....	41	....	26	....	23	56	....

, and Mar. 26, 1907, to Dec. 31, 1909, determined from a
. 1, 1906, to Mar. 25, 1907, determined from readings at
to May 13, 1910, as published in Water-Supply Paper
low of Borden Brook and is not considered reliable.
ed by subtracting from the total flow at the diversion
m the Borden Brook reservoir or by adding the amount
dicated by the elevation of the water surface in the reser-
tion and seepage from the reservoir, the results show the
nately. For days when no discharge records are given,
er than the total flow at the diversion dam. Discharge
ners of Springfield.

Monthly discharge of Westfield Little River near Westfield, Mass., for the years ending Sept. 30, 1905–1909.

[Original site, drainage area, 43 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1905.						
August	220	11.6	41.0	0.953	1.10	B.
September	832	25.9	136	3.16	3.53	B.
1905–6.						
October	203	17.8	43.8	1.02	1.18	B.
November	227	23.3	51.9	1.21	1.35	B.
April	1,060	67.2	288	6.70	7.48	B.
May	426	11.2	74.3	1.73	1.99	B.
June	105	12.9	47.1	1.10	1.23	B.
July	93.9	8.7	27.0	.628	.72	B.
August	69.8	6.0	17.4	.405	.47	B.
September	38.1	2.8	9.0	.209	.23	B.
1906–7.						
October	297	7.3	42.9	.998	1.15	B.
November	367	11.6	57.6	1.34	1.50	B.
December	162	27.0	81.9	1.90	2.19	C.
January	448	42.6	141	3.28	3.78	C.
February	89.6	37.1	52.0	1.21	1.26	C.
March	545	28.0	170	3.95	4.55	C.
April	360	69.8	117	2.72	3.04	B.
May	336	41.9	89.7	2.09	2.41	B.
June	412	14.0	92.9	2.16	2.41	B.
July	35.5	5.3	13.9	.323	.37	B.
August	9.8	3.0	5.65	.131	.15	B.
September	752	2.8	80.9	1.88	2.10	B.
The year	752	2.8	78.9	1.83	24.91	
1907–8.						
October	1,590	29.2	242	5.63	6.49	B.
November	1,040	55.3	222	5.16	5.76	B.
December	647	54.4	191	4.44	5.12	C.
January	780	....	165	3.84	4.43	C.
February	808	34.7	141	3.28	3.54	C.
March	885	39.9	292	6.79	7.83	B.
April	430	66.0	134	3.12	3.48	B.
May	668	29.9	180	4.19	4.83	B.
June	189	7.0	27.4	.637	.71	B.
July	127	5.7	18.8	.437	.50	B.
August	58.7	5.8	14.1	.328	.38	B.
September	37.3	2.9	5.71	.133	.15	B.
The year	1,590	2.9	136	3.16	43.22	
1908–9.						
October	39.9	4.9	10.0	.233	.27	B.
November	16.4	8.2	11.8	.274	.31	B.
December	98.5	7.6	35.6	.828	.95	B.
January	721	13.3	79.6	1.85	2.13	C.
February	1,020	14.2	230	5.35	5.57	C.
March	1,380	44.8	187	4.35	5.02	B.
April	1,380	75.2	258	6.00	6.69	B.
May	440	34.7	104	2.42	2.79	B.
June	88.0	8.0	29.2	.679	.76	B.
July	16.4	3.6	7.92	.184	.21	B.
August	88.0	2.2	13.3	.309	.36	B.
September	38.1	3.3	9.36	.218	.24	B.
The year	1,380	2.2	80.1	1.86	25.30	
1909.						
October	21.1	6.4	10.1	.235	.27	B.
November	23.3	7.0	11.5	.268	.30	B.
December	266	13.3	46.8	1.09	1.26	C.

iver near Westfield, Mass., for the years ending 30, 1910–1915.

inage area, 48 square miles.]

Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
mum.	Minimum.	Mean.	Per square mile.		
138	28	55.8	1.16	0.73	
389	(a)	92.9	1.94	2.16	
42	(a)	12.3	.256	.29	
61	(a)	12.3	.256	.29	
28	(a)	8.18	.170	.19	
8.1	(a)	1.71	.035	.04	
167	(a)	39.1	.815	.88	
54	(a)	15.3	.319	.36	
188	5.5	50.1	1.05	1.21	
33	3.2	21.1	.440	.46	
650	18	93.3	1.94	2.24	
663	89	184	3.83	4.27	
141	17	62.3	1.30	1.50	
365	.8	79.1	1.65	1.84	
68	(a)	15.9	.331	.38	
137	2	23.8	.496	.57	
237	20	62.8	1.31	1.46	
663	(a)	53.9	1.12	15.21	
280	30	248	5.17	5.96	
310	66	133	2.77	3.09	
352	45	113	2.35	2.71	
258	31	75.6	1.58	1.82	
355	44	137	2.85	3.07	
310	98	353	7.35	8.47	
326	94	250	5.21	5.81	
486	49	152	3.17	3.66	
286	4.2	43.2	.900	1.00	
25	(a)	6.24	.130	.15	
37	(a)	11.5	.240	.28	
52	(a)	17.2	.358	.40	
310	(a)	128	2.67	36.42	
303	(a)	37.1	.752	.87	
364	33	94.9	1.98	2.21	
521	35	115	2.40	2.77	
504	47	167	3.48	4.01	
170	23	49.7	1.03	1.07	
,120	40	209	4.34	5.00	
469	37	132	2.75	3.07	
485	22	89.7	1.87	2.16	
65	(a)	20.8	.435	.49	
15	(a)	2.4	.050	.06	
27	(a)	3.5	.074	.09	
49	(a)	8.2	.170	.19	
,120	(a)	77.8	1.62	21.99	
872	5.2	100	2.08	2.40	
649	28	115	2.39	2.67	
252	33	78.7	1.64	1.89	
259	19	57.0	1.19	1.37	
247	27	65.9	1.37	1.43	
,490	59	232	4.83	5.57	
747	134	313	6.52	7.28	
373	16	110	2.29	2.64	
26	(a)	13.1	.273	.30	
53	(a)	13.2	.275	.32	
19	(a)	5.39	.112	.13	
15	(a)	2.36	.049	.05	
,490	(a)	92.1	1.92	26.05	

was equal to or greater than the total flow at the diversion

Monthly discharge of Westfield Little River near Westfield, Mass., for the years endi Sept. 30, 1910–1915—Continued.

[Present site; drainage area, 48 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Ac rac
	Maximum.	Minimum.	Mean.	Per square mile.		
1914-15.						
October	18	(a)	5.2	0.108	0.12	
November	151	(a)	41.7	.869	.97	
December	40	1.6	17.3	.360	.42	
January	925	.5	178	3.71	4.28	
February	1,850	49	251	5.23	5.45	
March	114	21	51.3	1.07	1.23	
April	767	28	140	2.92	3.26	
May	228	26	81.3	1.69	1.95	
June	125	3.6	35.0	.729	.81	
July	962	20	112	2.33	2.69	
August	697	19	104	2.17	2.50	
September	78	(a)	20.4	.425	.47	
The year	1,850	(a)			24.25	

[a] On certain days the apparent storage release was equal to or greater than the total flow at t diversion dam.

BORDEN BROOK NEAR WESTFIELD, MASS.[1]

Location.—At outlet of Borden Brook reservoir in the town of Granville, 2 miles abo confluence of Borden and Pebble brooks and about 8 miles west of Westfield.

Drainage area.—8 square miles.

Records available.—January 1, 1910, to September 30, 1915.

Determination of discharge.—Flow determined from a continuous record of t head on a 5-foot sharp-crested weir without end contractions; results are th corrected for apparent gain or loss in stored water in the reservoir, but allowance is made for evaporation.

Extremes of discharge.—Maximum 24-hour flow recorded: 294 second-feet, Octob 21, 1911. Minimum flow: Zero at various times when the water apparent released from storage was equal to, or greater than, the flow measured at the w

Cooperation.—Records furnished by the board of water commissioners of Springfiel through E. E. Lochridge, chief engineer.

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[1] Formerly described as near Blandford, Mass.

Brook near Westfield, Mass., for the years ending 30, 1910–1915.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
......	93	15	22	8.1	7.3	......	......
3.2	132	......	22	7.6	7.3	......	......
6.4	57	20	20	7.6	18	......	12
6.4	41	20	17	7.8	7.3	......	4.7
6.4	59	10	16	10	13	......	......
6.4	85	20	13	14	1.8	......	9.9
6.5	95	10	10	17	18	......	......
6.5	62	21	8.6	20	18	......	......
6.5	71	10	9.0	23	7.3	......	......
6.5	45	......	13	27	......	......	9.9
6.5	9.1	10	14	32	......	......	......
6.5	27	10	13	32	......	......	14
13	27	10	12	32	......	......	25
6.5	18	10	11	31	......	......	......
6.5	18	10	10	24	......	......	......
13	18	11	9.4	17	......	9.5	......
6.7	46	11	7.5	18	11	......	......
6.7	9.1	21	6.3	19	......	......	......
13	37	21	7.8	17	......	4.7	......
13	27	21	8.6	15	......	......	......
47	27	11	9.5	12	......	......	......
34	55	11	11	8.3	......	2.6	......
20	56	5.4	10	5.4	......	......	2.0
14	85	5.4	10	3.3	......	......	6.7
14	135	76	10	2.3	......	......	......
14	108	239	10	1.5	......	......	......
85	40	108	9.8	1.1	......	......	1.7
152	40	5.0	5.6	13	......	7.8	......
......	60	5.0	3.1	7.3	......	15	24
......	97	15	3.3	7.3	......	3.1	2.9
......	49	......	6.8	......	......	16	......
......	......	20	20	10	......	......	20
7.8	7.8	16	20	......	2.4	......	9.3
......	......	9.0	10	......	......	......	......
7.8	......	18	10	......	......	......	12
......	7.8	27	10	10	......	......	......
7.8	......	119	10	42	......	......	7.8
......	......	64	10	74	......	......	......
7.8	7.8	46	10	43	......	......	31
......	......	28	10	33	......	......	51
......	......	28	10	11	......	......	31
7.8	7.8	28	......	......	......	......	42
......	......	28	......	43	......	......	22
......	7.8	28	10	43	......	......	11
7.8	16	47	......	33	......	......	11
......	31	48	10	11	......	......	11
......	7.8	38	......	11	......	......	......
7.8	7.8	19	......	......	......	......	9.8
......	7.8	20	......	......	......	......	11
......	7.8	20	40	11	......	......	......
7.8	7.8	20	30	......	......	......	......
......	7.8	39	20	......	......	......	11
......	23	30	......	......	......	......	......
......	16	20	10	......	......	......	......
7.8	16	20	......	......	......	......	11
......	16	20	10	11	......	......	......
7.8	25	20	10	......	......	......	11
7.8	108	10	10	......	......	......	......
7.8	51	20	10	......	......	......	......
......	121	10	......	......	......	......	11
......	97	20	10	......	......	......	11
......	36	......	......	......	......	24	......

Daily discharge, in second-feet, of Borden Brook near Westfield, Mass., for the years endin Sept. 30, 1910–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	43	9.3	22	22	11	9.0	62	18	62	3.2	......	10
2	33	34	11	11	......	8.6	97	18	14	......	......	11
3	33	.6	9.3	.4	......	6.8	105	13	7.8	......	......	11
4	33	1.1	11	.4	11	5.0	73	13	3.6	......	......	......
5	22	33	11	33	......	4.6	54	13	1.3	......	......	......
6	11	22	......	22	11	3.9	51	13	.4	......	......	9.
7	22	30	11	22	......	3.5	86	13	.4	......	......	......
8	22	18	......	......	......	3.5	68	18	.4	......	......	......
9	11	14	11	11	11	3.9	60	23	.3	......	......	......
10	11	......	......	11	......	3.9	60	23	.2	......	......	......
11	11	8.7	11	......	......	2.8	14	18	.1	......	0.2	......
12	......	15	22	......	......	20	31	19	.1	......	......	......
13	11	15	......	......	11	34	12	19	.1	......	......	14
14	......	19	22	......	......	34	31	13	.1	......	......	......
15	11	41	11	11	......	101	46	14	......	......	......	......
16	......	30	43	......	11	120	49	48	......	......	......	11
17	9.3	30	30	......	......	68	29	59	......	......	......	6.7
18	146	63	33	......	......	58	34	30	......	......	......	10
19	128	41	22	4.4	11	58	62	8.0	......	......	......	.9
20	75	41	40	2.2	......	58	54	3.6	......	......	......	10
21	294	41	11	......	45	43	24	3.9	......	.8	......	.9
22	281	30	55	11	9.3	26	42	2.8	......	......	......	10
23	255	41	65	11	......	21	14	2.5	......	......	......	......
24	198	19	17	......	......	17	14	5.4	......	......	......	17
25	83	19	33	......	19	16	16	7.6	6.4	......	......	8.2
26	9.3	8.6	33	11	9.3	11	8.0	5.1	......	6.7	9.1	18
27	19	......	22	11	5.8	4.4	8.0	2.8	......	......	8.2	1.6
28	9.3	7.9	11	11	11	24	14	1.3	......	......	6.7	10
29	9.3	8.6	22	......	9.5	44	14	21	......	......	......	10
30	19	13	33	11	......	64	17	69	......	7.4	9.5	.9
31	......	......	33	......	......	64	......	77	......	......	10	......
1912–13.												
1	6.7	20	11	58	11	18	25	16	11	......	......	......
2	6.7	11	22	35	10	19	11	2.4	3.1	......	5.6	......
3	8.2	9.3	11	28	......	13	17	8.1	7.2	......	......	......
4	8.2	......	11	28	5.6	10	28	6.2	4.6	......	......	......
5	......	......	11	12	5.0	3.4	13	5.4	2.8	......	......	......
6	......	11	11	15	4.3	3.4	19	5.0	2.3	......	1.4	......
7	7.0	90	11	47	3.1	3.9	16	4.3	2.6	......	......	......
8	......	101	11	25	2.8	3.5	14	......	4.3	......	......	......
9	......	40	......	33	2.2	14.6	.3	......	3.6	......	2.9	......
10	......	42	11	15	1.7	19	8.5	......	......	......	......	......
11	......	9.3	......	15	1.7	17	113	......	......	......	......	......
12	......	22	11	15	......	32	121	......	......	......	1.4	3.9
13	......	20	11	15	......	30	81	......	......	15	......	......
14	......	42	......	15	......	47	45	......	......	......	......	......
15	......	11	......	19	......	98	31	......	......	......	2.9	2.2
16	......	11	......	19	......	65	18	......	......	......	......	14
17	......	11	......	22	......	45	20	......	......	......	......	4.4
18	......	11	......	36	......	25	17	......	......	......	1.4	......
19	......	11	11	15	......	26	14	......	1.1	......	......	......
20	......	9.3	11	18	......	46	11	......	18	.1	......	......
21	......	......	11	18	9.5	64	......	10	......	......	......	14
22	......	......	......	17	17	46	6.4	5.7	......	......	1.9	9.3
23	78	11	11	29	13	24	6.7	90	......	......	......	......
24	59	22	11	12	11	19	6.7	78	2.7	......	......	9.3
25	29	11	......	19	......	162	5.8	41	......	......	2.9	......
26	39	11	11	16	3.8	123	5.0	25	5.6	......	......	3.8
27	31	11	22	13	17	164	6.3	12	......	......	......	......
28	31	11	22	11	13	110	35	103	......	5.3	......	......
29	9.3	11	11	......	......	64	25	62	......	......	22	......
30	11	......	57	5.2	......	44	11	44	......	......	8.2	......
31	9.3	......	46	17	......	48	......	21	......	1.4	4.5	......

Brook near Westfield, Mass., for the years ending
10–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	34	94	102	30	......	......	......	......
	48	82	99	16	......	......	......	......
	29	56	64	20	......	22	......	......
	30	54	60	16	......	......	......	......
	26	48	38	85	......	......	......	......
	24	30	40	75	......	......	......	......
	11	33	44	39	......	......	......	......
	16	29	172	30	......	11	......	......
	14	15	132	35	......	11	......	......
	3.5	22	85	37	......	......	......	......
	9.7	19	66	17	......	......	......	......
	6.7	6.9	65	64	......	......	......	......
	21	14	62	55	......	3.0	......	......
	14	13	39	40	......	......	......	......
	9.5	16	44	28	......	7.1	......	......
	......	24	44	19	......	.4	......	......
	5.5	37	78	21	......	6.7	......	......
	7.2	26	76	16	......	......	......	......
	6.7	26	73	14	......	......	......	......
	6.7	24	116	12	......	......	......	......
	6.2	13	82	11	......	......	......	......
	5.4	19	45	8.2	......	......	......	......
	5.0	17	42	4.3	......	......	......	......
	5.0	16	23	4.6	......	......	......	......
	5.4	16	43	3.9	......	......	......	......
	5.8	65	76	3.9	......	......	......	......
	5.8	255	76	3.9	......	......	......	......
	5.4	218	53	3.1	5.0	......	......	......
	......	117	39	......	.4	......	......	......
	......	66	29	......	......	......	......	......
	......	68	......	......	......	......	......	......
	27.9	21.7	9.3	29.0	......	6.8	......	3.8
3	18.6	......	......	25.8	......	6.7	......	3.2
7	18.6	10.8	10.8	9.4	......	8.1	......	2.2
2	9.3	......	......	15.6	......	6.8	146	......
0	9.3	10.8	10.8	12.2	......	5.4	76.3	......
..	48.0	18.6	10.8	......	......	4.0	37.2	......
6	38.7	11.2	21.7	4.7	......	2.9	24.5	......
5	20.0	11.2	32.5	5.8	......	127	13.2	......
0	20.1	11.2	21.7	5.8	......	78.2	14.5	......
7	18.6	11.2	32.5	5.8	......	37.5	......	......
..	10.8	11.2	163	5.8	......	21.2	4.4	......
6	9.3	11.2	88.2	4.7	4.0	10.0	1.9	......
1	20.1	11.2	37.2	3.5	......	13.4	1.1	......
0	......	22.1	24.9	2.3	7.1	......	......	......
3	77.4	11.2	13.9	......	8.2	2.1	......	......
0	60.4	11.2	15.0	......	17.5	......	......	......
1	40.2	11.2	15.0	......	12.9	......	......	12.9
	20.1	22.1	15.0	......	9.3	......	......	12.4
	20.1	12.8	15.0	......	18.6	......	......	......
.2	9.3	.4	14.5	......	9.9	......	......	......
.9	10.8	11.2	.6	8.4	11.0	......	9.5	......
.3	9.3	12.8	5.8	9.1	2.2	......	22.7	37.2
.2	20.1	11.5	6.2	10.0	2.2	......	20.4	......
.3	243	9.3	5.9	7.3	......	......	20.4	9.3
.9	245	21.7	4.6	4.2	......	......	16.9	......
.3	54.2	......	3.5	3.1	......	......	......	......
.3	21.7	10.8	2.8	......	......	......	4.6	......
.6	21.7	......	2.8	......	......	6.6	2.8	......
.3	......	......	2.8	......	......	5.0	3.2	......
.3	......	10.8	42.1	......	......	5.0	5.5	......
.3	......	10.8	......	......	......	......	5.8	......

---

acting from the quantity of water passing over the weir the
ervoir, or by adding the amount apparently stored in the reser-
face in the reservoir. As no allowance has been made for evapo-
results show the natural flow at the outlet of the reservoir only
arge is not given, the amount apparently released from storage
assing over the weir.

Monthly discharge of Borden Brook near Westfield, Mass., for the years ending Sept. 30, 1910–1915.

[Drainage area, 8 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1910.					
January	210		24.8	3.10	3.57
February	152		18.8	2.35	2.45
March	135	9.1	55.7	6.96	8.02
April	239		24.7	3.09	3.45
May	22	3.1	10.9	1.36	1.57
June	32	1.1	14.7	1.84	2.05
July	18		3.52	.440	.51
August	16		1.89	.236	.27
September	25		3.76	.470	.52
1910–11.					
October	8.1		1.71	.214	.25
November	43		4.59	.574	.64
December			.00	.000	.00
January	52		7.94	.992	1.14
February	7.8		3.34	.418	.44
March	121		20.7	2.59	2.99
April	119	9.0	29.3	3.66	4.08
May	40		9.35	1.17	1.35
June	74		12.9	1.61	1.80
July	2.4		.08	.010	.01
August	24		.80	.100	.12
September	51		11.1	1.39	1.55
The year	121		8.44	1.06	14.37
1911–12.					
October	294		58.4	7.30	8.42
November	63		21.8	2.72	3.04
December	65		21.1	2.64	3.04
January	33		6.98	.872	1.01
February	45		6.41	.801	.86
March	120	2.8	30.4	3.80	4.38
April	105	8.0	41.6	5.20	5.80
May	77	1.3	19.2	2.40	2.77
June	62		3.24	.405	.45
July	7.4		.58	.073	.08
August	10		1.41	.176	.20
September	18		5.68	.710	.79
The year	294		18.1	2.26	30.84
1912–13.					
October	78		10.8	1.35	1.56
November	101		18.6	2.32	2.59
December	57		11.5	1.44	1.66
January	58		20.7	2.59	2.99
February	17		4.70	.588	.61
March	164		41.7	5.21	6.01
April	121		24.4	3.05	3.40
May	103		17.4	2.18	2.51
June	18		2.29	.286	.32
July	15		.70	.088	.10
August	22		1.78	.222	.26
September	14		2.03	.254	.28
The year	164		13.1	1.64	22.29
1913–14.					
October	221		24.0	3.00	3.46
November	161		22.2	2.78	3.10
December	87		14.8	1.85	2.13
January	47		10.1	1.26	1.45
February	48		13.1	1.64	1.71
March	255	6.9	49.6	6.20	7.15
April	172	23	66.9	8.36	9.33
May	85		23	2.88	3.32
June	5.0		.18	.022	.02
July	22		1.97	.246	.28
August			.00	.000	.00
September			.00	.000	.00
The year	255		18.8	2.35	31.95

ENCE DAM, MERRIMACK RIVER, AUGUST, 1915.

TON RIVER NEAR NEW BOSTON, MASS., MARCH 4, 1914.

iear Westfield, Mass., for the years ending Sept. 30,
915—Continued.

Discharge in second-feet.				Run-off (depth in inches on drainage area).
Maximum.	Minimum.	Mean.	Per square mile.	
....	....	0.00	0.000	0.00
25.2	....	6.59	.824	.92
9.8	....	3.60	.450	.52
152	....	29.1	3.64	4.20
245	....	40.1	5.01	5.22
22.1	....	10.7	1.34	1.54
163	....	21.0	2.62	2.92
29.0	....	5.56	.695	.80
18.6	....	3.43	.429	.48
127	....	11.2	1.40	1.61
146	....	13.9	1.74	2.01
37.2	....	2.70	.338	.38
245	....	12.1	1.51	20.60

ıum or minimum is given see footnote to daily-discharge table.

NGTON RIVER BASIN.

ENERAL FEATURES.

ned at New Hartford, Conn., by the union
:hes. The West Branch, the continuation
in the western part of the town of Becket,
ows southerly and southeasterly through
ınd Tolland to the State line at Colebrook,
art of Litchfield County, Conn., and passes
elow New Hartford the river continues its
rmington, where it turns abruptly and flows
le. From Tariffville its general course is
ıdsor, where the river joins the Connecticut.
he head of the West Branch to Colebrook
et. The total drainage area of the West
ne is 103 square miles, of which 92.7 square
g station 1 mile below New Boston. (See

ıtains numerous small lakes and ponds, and
tributaries from both east and west. The
3rook, enters near New Boston.

ell wooded, and lumbering operations are
ough the manufacturing of timber products
wing to lack of transportation facilities. A
sites have been partly developed, but most
ving small head and little storage capacity.
rage has been developed in Otis reservoir,
l reservoir site and is fed by tributaries from
ne operation of this reservoir greatly affects
especially at low-water periods.

FARMINGTON RIVER NEAR NEW BOSTON, MASS.[1]

Location.—At a highway bridge a quarter of a mile below Clam River and about 1 mile south of New Boston.

Drainage area.—92.7 square miles.

Records available.—May 27, 1913, to September 30, 1915.

Gages.—Barrett & Lawrence water-stage recorder installed June 11, 1913, on left bank on downstream side of bridge; referred to gage datum by a hook gage inside the well; vertical staff installed May 27, 1913, on bridge abutment is used for auxiliary readings.

Discharge measurements.—Made from a cable or by wading.

Channel and control.—Channel rocky and filled with bowlders; a slight shift in control has been caused by removal of rocks from channel.

Extremes of discharge.—Maximum stage recorded: 7.64 feet, October 26, 1913; approximate discharge, 3,200 second-feet. Minimum stage recorded: 2.22 feet, August 27, 1913; discharge, 4.4 second-feet.

Winter flow.—Discharge relation affected by ice. (See Pl. X, *B*.)

Regulation.—Flow affected by storage in Otis reservoir about 5 miles above New Boston and by operation of a woodworking shop just above the station.

Accuracy.—Open-water records good.

Discharge measurements of Farmington River near New Boston, Mass., during 1913–1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1913.		*Feet.*	*Sec.-ft.*	1914.		*Feet.*	*Sec.-ft.*
June 9	R. S. Barnes	3.11	64	Mar. 31	C. H. Pierce	4.96	630
13	do	3.68	157	Apr. 9	R. S. Barnes	6.15	1,540
Oct. 9	do	2.30	6.6	9	do	5.60	1,120
9	do	2.70	29.6	9	do	5.00	644
15	do	2.96	42.4	May 24	do	3.36	100
15	do	2.95	41.8	24	do	3.38	102
15	do	2.98	43.9	Aug. 15	C. H. Pierce	3.38	104
				Sept. 10	R. S. Barnes	3.45	141
1914.				Dec. 18	do	[a] 3.08	40.8
Jan. 6	R. S. Barnes	[a] 3.38	75.1				
13	do	[a] 3.55	87.4	1915.			
28	do	[a] 5.31	128	Feb. 3	R. S. Barnes	[a] 3.82	151
Feb. 13	do	[a] 4.34	162	Mar. 4	do	3.65	151
Mar. 4	do	[a] 7.50	345	June 21	C. H. Pierce	3.48	122
31	C. H. Pierce	4.76	520				

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Farmington River near New Boston, Mass., for the years ending Sept. 30, 1913–1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1913.						1913.					
1		149	100	118	93	16		115	124	128	32
2		128	58	117	26	17		108	128	132	35
3		108	19	117	12	18		112	124	130	32
4		92	84	112	14	19		112	128	130	32
5		76	92	113	53	20		112	126	115	26
6		76	95	113	80	21		96	120	113	36
7		89	90	115	79	22		36	118	117	149
8		103	92	112	70	23		53	117	95	86
9		65	128	117	62	24		102	120	15	40
10		62	118	112	60	25		100	118	40	26
11		60	132	108	56	26		102	115	96	26
12		158	128	102	57	27	105	105	117	48	23
13		147	128	99	54	28	186	105	126	106	21
14		53	126	102	52	29	650	102	39	112	20
15		74	126	110	40	30	309	99	115	113	23
						31	184		118	108	

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[1] Called West Branch of Farmington River in Water-Supply Paper 351.

rmington River near New Boston, Mass., for the
- 30, 1913-1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
280	280	600	337	63	107	110	90
315	332	980	302	60	70	110	88
218	368	680	238	60	51	108	60
232	425	478	224	84	47	106	12
218	405	375	455	90	102	107	9.6
156	385	320	805	71	107	107	9.6
167	368	356	550	58	107	105	30
145	368	770	415	52	75	102	50
156	350	1,310	337	63	47	105	70
167	332	770	286	56	42	107	91
135	315	600	254	52	54	106	112
135	298	680	320	49	98	105	131
125	298	550	625	45	49	108	122
125	280	415	478	45	98	102	114
116	264	375	375	52	91	99	106
107	247	375	302	98	93	98	106
99	247	435	254	105	90	102	107
99	232	478	224	105	60	102	110
91	218	500	162	105	94	102	107
84	238	600	141	118	112	102	107
77	224	600	131	114	98	99	106
71	198	478	112	106	102	98	106
65	173	356	106	105	102	100	105
65	141	269	98	105	122	104	104
60	131	302	91	104	116	108	104
55	302	770	81	102	116	112	102
50	980	550	78	102	108	116	21
46	1,900	395	77	106	104	120	12
....	1,060	269	76	107	110	122	65
....	680	286	71	108	118	108	90
....	600	....	67	....	118	93	....
269	269	77	197	67	116	56	96
173	210	84	173	61	162	54	80
151	162	87	162	54	151	105	65
141	151	82	141	52	151	574	62
131	131	93	131	47	141	1,060	58
210	116	141	131	47	141	500	55
286	108	151	116	47	518	375	52
197	104	185	151	50	1,700	238	50
151	105	210	162	47	1,310	185	48
151	104	224	131	43	550	141	46
197	87	375	112	41	337	114	44
173	87	980	105	40	269	98	42
122	86	525	98	37	224	112	39
112	77	337	87	32	151	99	37
141	77	254	81	34	110	84	37
710	90	197	78	107	90	75	46
415	65	173	81	162	93	107	49
302	75	162	90	151	96	87	56
238	60	162	82	98	99	65	58
185	71	151	73	151	102	60	58
162	73	141	71	122	104	55	105
151	75	122	141	86	105	212	122
162	77	118	162	86	107	415	90
337	84	118	141	90	96	185	65
2,000	91	108	114	74	84	151	49
875	87	110	104	60	68	122	43
455	83	112	112	56	65	98	52
337	79	105	98	71	62	110	49
....	75	106	87	62	98	87	44
....	71	162	77	62	80	100	41
....	74	....	74	....	62	112	....

rating curves—one applicable Oct. 11, 1913, to Mar. 19, 1914,
le for the rest of the period, well defined below 1,500 second-feet.
to Mar. 19, 1914, Dec. 16, 1914, to Jan. 5, 1915, and Jan. 31 to
neans of gage heights, discharge measurements, and weather
913, Jan. 6 to Mar. 19, 1914, Dec. 16, 1914, to Jan. 5, 1915, and
lated Aug. 23-28, 30, Sept. 7-10, 13, 14, and 20-24, 1914: July 7,
—6, 8, 9, and 11-13, 1915, as the water-stage recorder was not

Monthly discharge of Farmington River near New Boston, Mass., for the years endin Sept. 30, 1913–1915.

[Drainage area, 92.7 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1913.						
May 27-31	650	105	287	3.10	0.58	C.
June	158	36	96.6	1.04	1.16	A.
July	132	19	109	1.18	1.36	A.
August	132	15	105	1.13	1.30	A.
September	149	12	47.2	.509	.57	A.
1913–14.						
October	950	18	136	1.47	1.70	C.
November	744	56	183	1.97	2.20	C.
December	250	63	111	1.20	1.38	C.
January	300	34	80.0	.863	.99	D.
February	315	46	130	1.40	1.46	D.
March	1,900	131	408	4.40	5.07	C.
April	1,310	269	531	5.73	6.39	C.
May	805	67	260	2.80	3.23	B.
June	114	45	83.0	.895	1.00	A.
July	122	42	90.6	.978	1.13	A.
August	122	93	106	1.14	1.31	C.
September	131	9.6	81.6	.880	.98	C.
The year	1,900	9.6	183	1.97	26.84	
1914–15.						
October	65	7.0	19.9	.215	.25	B.
November	49	12	27.0	.291	.32	B.
December	71	23	41.3	.446	.51	C.
January	980	29	274	2.96	3.41	B.
February	2,000	112	319	3.44	3.58	B.
March	269	60	100	1.08	1.24	A.
April	980	77	195	2.10	2.34	A.
May	197	71	115	1.24	1.43	A.
June	162	32	71.2	.768	.86	A.
July	1,700	62	240	2.59	2.99	A.
August	1,060	54	188	2.03	2.34	A.
September	122	37	57.9	.625	.70	A.
The year	2,000	7.0	136	1.47	19.97	

nington River near New Boston, Mass., during
ng Sept. 30, 1913–1915.

Days of deficiency in discharge.		
a 1913	1913–14	1914–15
0	2	3
4	5	33
12	12	54
19	26	84
23	44	115
38	90	162
56	145	214
122	250	273
125	270	313
125	286	325
125	300	332
126	315	339
126	327	343
126	333	346
126	338	348
126	344	354
127	353	357
....	357	358
....	358	359
....	362	361
....	364	363
....	365	364
....	....	365

ay 27 to Sept. 30, 1913.

ical horsepower per foot fall that may be developed at different of days on which the discharge and corresponding horsepower en in the columns for discharge and horsepower. In using this rious losses, the principal ones being the wheel loss, which may , which may be as large as 5 per cent.

ON RIVER BASIN.

ERAL FEATURES.

ton River rise in the swamps and small Bristol counties, in the eastern part of river is formed in the eastern part of ter by the union of Matfield and Town

rains the larger area and is considered the stream, rises in the swamp northeast of eneral southeasterly to its junction with

the Matfield is joined by Beaver Brook, ips of Whitman and Abington, and near ucket River, which drains several large st Bridgewater, Whitman, Abington, Hali- River rises in Stoughton and Easton, flows of about 7,000 acres, known as Great Cedar natural reservoir passes eastward through on with Matfield River at Paper Mill village.

Below this point the general course of the Taunton is southeasterly and southerly to the head of Narragansett Bay, into which it discharges. From the head of Matfield River (called Salisbury Plains River in its upper course) to Narragansett Bay the distance along the stream is about 50 miles.

The principal tributaries of Taunton River are Wenatuxet, Namasket, Mill, and Threemile rivers, the last two entering below tidewater Wenatuxet River rises in several small ponds in Plympton and Carve and flows in a general westerly course, receiving Raven Brook and Bartletts Brook from the south. Namasket River enters the Taunton near Titicut. In its drainage area are Assawompsett and Long ponds. Mill River rises in Foxboro, Mansfield, and Easton, flow southward into Great Cedar Swamp, and joins the Taunton in the city of Taunton. Threemile River rises in Foxboro and flows southeastward, joining the Taunton at North Dighton. The Taunton is tidal up to East Taunton, where there is about 2½ feet of rise and fall, and it is navigable to Weir Village.

On account of the large number of small ponds and swamps in the area the run-off through the year is fairly uniform, except in the Matfield drainage basin. There are several power plants on the main river and on the branches.

The average rainfall in this region is about 46 inches. On account of the proximity of this basin to the ocean the winters are not severe

The country as a whole is very flat, swamps are numerous, and not much rock is found. The western portion of the drainage area is clay bottom and the eastern is sandy but fairly fertile. Nearly all the timber has been removed.

MATFIELD RIVER AT ELMWOOD, MASS.

Location.—At the Bedford Street Bridge in the village of Elmwood, in the southern part of the town of East Bridgewater.

Drainage area.—Not measured.

Records available.—Discharge measurements September 29, 1909, to March 5, 1910

Gage.—Temporary staff; later replaced by a chain gage attached to the bridge.

Discharge measurements.—Made from the bridge, or by wading.

Channel and control.—Bed of stream rocky. One channel at all stages. Control not defined.

Regulation.—Flow regulated to some extent by dams above the station.

A gage-height record was obtained from September 29, 1909, to July 10, 1910, but on account of the variable backwater at the station from Taunton River it is not considered a true index of the discharge and is not published.

l River at Elmwood, Mass., during 1909–10.

is- arge.	Date.	Made by—	Gage height.	Discharge.
c.-ft.	1909.		*Feet.*	*Sec.-ft.*
34.4	Dec. 17	P. M. Churchill........	2.53	61.7
11.3				
11.9	1910.			
6.0	Jan. 7	P. M. Churchill........	4.98	324
5.7	22	.....do.................	5.90	642
6.1	Feb. 15	Bartlett and Stanford..	2.83	70
6.4	15	.....do.................	2.79	66
44.6	19	P. M. Churchill........	4.90	328
33.4	Mar. 5	L. W. Bartlett.........	4.72	236
33.1				

ading and referred to datum of chain gage by means of curve

ER NEAR ELMWOOD, MASS.

et below dam of Carver Cotton Gin Co., about 1½

easurements September 29, 1909, to May 7, 1910.

from the bridge, or by wading.
ream of gravel and sand; at some seasons covered
at all stages. Control not defined, owing to the
other obstructions.

n stages entire flow is regulated by mills above

d from September 29, 1909, to July 10, 1910, but
ills and the variable backwater at the station it is
discharge and is not published.

ket River near Elmwood, Mass., during 1909–10.

Discharge.	Date.	Made by—	Gage height.	Discharge.
Sec.-ft.	1910.		*Feet.*	*Sec.-ft.*
27.8	Feb. 9	P. M. Churchill........	4.09	155
14.9	15	T. W. Norcross.........	2.01	36.0
12.8	15	W. S. Stanford.........	2.96	98.9
5.7	15	L. W. Bartlett.........	3.00	98.1
9.3	15	W. S. Stanford.........	2.90	105
6.8	19	P. M. Churchill........	4.09	155
67.6	Mar. 5	Bartlett and Stanford..	4.88	220
73.1	8	P. M. Churchill........	4.63	191
74.4	16	.....do.................	2.99	92.3
74.3	17	Bartlett and Stanford..	3.08	123
	26	.....do.................	1.67	59.5
	May 7	.....do.................	1.35	35.1
168	7	.....do.................	1.35	38.9
291				

CHARLES RIVER BASIN.

GENERAL FEATURES.

Charles River rises in the town of Hopkinton, Middlesex Count
at altitude 400 feet above sea level; flows southward about 9 mile
then very irregularly northeastward 65 miles to the point at which
enters Boston Bay. Its drainage area comprises 290 square miles,
which 156.3 square miles is above Waban Lake. Distributed alo
the river are 26 dams, aggregating in height 202 feet, which furni
water power for numerous factories and mills.

The principal tributaries of the river are Mine and Sheppar
brooks, Stop River, and Bogastow, Stony, and Beaver brooks. Ju
above its entrance into Boston Harbor it is joined by Mystic Riv
which drains an area lying to the north. The Mystic rises just we
of Reading, at altitude 100 feet above sea level, and flows southwa
and southeastward about 16 miles, passing through Richardsons a
Burbank ponds and Mystic Lake. The fall from the source of t
river to Mystic Lake is 80 feet.

The area tributary to Mystic Lake contains 26.9 square miles, i
cluding about 3 per cent of water surface. It was formerly a sour
of water supply for the city of Charlestown, but was abandoned f
that purpose on January 1, 1898. The other lakes in this basin a
Wedge Pond, Winter Pond, Horn Pond, and Burbank Pond. Abe
jona River, flowing into Burbank Pond in East Woburn, is the pri
cipal source of the main stream.

CHARLES RIVER AT WALTHAM, MASS.

LOCATION.—At the city of Waltham. From October 4, 1903, to July 9, 1904, at t
plant of the Boston Manufacturing Co., at Moody Street; July 10, 1904,
October 2, 1909, at the dam of the Waltham Bleachery.

DRAINAGE AREA.—October 4, 1903, to July 9, 1904, 157 square miles;[1] July 10, 190
to October 2, 1909, 169 square miles.

RECORDS AVAILABLE.—October 4, 1903, to October 2, 1909.

DETERMINATION OF DISCHARGE.—Discharge October 4, 1903, to July 9, 1904, dete
mined from records of the horsepower of the wheels in operation in the factory
the Boston Manufacturing Co. and the quantity of water wasting over the da
Records after July 10, 1904, obtained at the Waltham Bleachery; method n
stated.

DIVERSIONS.—Mother Brook diverts water from Charles River at Dedham into N
ponset River.

COOPERATION.—Record furnished by Mr. Hiram A. Miller, former chief engineer
the Charles River Basin Commission.

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[1] During March, April, and May, 1904, water overflowed from the Stony Brook basin of the Cambrid
water supply.

r at *Waltham, Mass., for the years ending Sept. 30, 1904–1909.*

Week ending—	Discharge in second-feet.
1904–5.	
eb. 11	145
18	117
25	128
ar. 4	121
11	174
18	474
25	565
pr. 1	655
8	577
15	585
22	426
29	315
ay 6	223
13	151
20	110
27	162
une 3	78
10	97
17	98
24	139
uly 1	192
8	137
15	61
22	40
29	37
ug. 5	53
12	53
19	46
26	53
ept. 2	49
9	207
16	292
23	188
30	113
The year	179
1905–6.	
ct. 7	107
14	57
21	45
28	101
ov. 4	69
11	67
18	93
25	73
ec. 2	84
9	155
16	165
23	136
30	218
an. 6	238
13	243
20	248
27	323
eb. 3	306
10	174
17	169
24	253
ar. 3	406
10	567
17	561
24	372
31	440
pr. 7	600
14	518
21	514
28	372
ay 5	287
12	302
19	236
26	153
une 2	225
9	336
1905–6.	
June 16	204
23	158
30	121
July 7	133
14	164
21	127
28	134
Aug. 4	106
11	108
18	162
25	152
Sept. 1	114
8	68
15	53
22	23
29	70
The year	214
1906–7.	
Oct. 6	106
13	93
20	110
27	152
Nov. 3	218
10	166
17	169
24	221
Dec. 1	181
8	193
15	180
22	105
29	145
Jan. 5	311
12	487
19	421
26	406
Feb. 2	390
9	231
16	205
23	205
Mar. 2	141
9	181
16	190
23	547
30	586
Apr. 6	420
13	419
20	498
27	403
May 4	300
11	256
18	317
25	276
June 1	215
8	292
15	255
22	164
29	122
July 6	83
13	41
20	44
27	43
Aug. 3	43
10	29
17	24
24	22
31	19
Sept. 7	15
14	30
21	49
28	60
The year	207

Weekly discharge of Charles River at Waltham, Mass., for the years ending Sept. 30, 190 *1909*—Continued.

Week ending—	Discharge in second-feet.	Week ending—	Discharge in second-feet.	Week ending—	Dis- charg in secon feet
1907-8.		1907-8.		1908-9.	
Oct. 5	135	June 20	78	Feb. 6	1
12	222	27	37	13	3
19	147	July 4	27	20	4
26	101	11	18	27	6
Nov. 2	96	18	19	Mar. 6	6
9	249	25	31	13	4
16	398	Aug. 1	66	20	3
23	274	8	61	27	3
30	376	15	91	Apr. 3	5
Dec. 7	429	22	87	10	4
14	346	29	31	17	3
21	335	Sept. 5	47	24	4
28	435	12	60	May 1	4
Jan. 4	590	19	13	8	5
11	475	26	9	15	4
18	520			22	3
25	371	The year	239	29	2
Feb. 1	322			June 5	1
8	291	1908-9.		12	1
15	201	Oct. 3	19	19	1
22	429	10	31	26	1
29	447	17	24	July 3	
Mar. 7	476	24	33	10	
14	436	31	56	17	
21	450	Nov. 7	68	24	
28	505	14	43	31	
Apr. 4	379	21	48	Aug. 7	
11	392	28	61	14	
18	324	Dec. 5	39	21	
25	242	12	70	28	
May 2	225	19	81	Sept. 4	
9	188	26	80	11	
16	217	Jan. 2	74	18	
23	197	9	93	25	
30	158	16	129	Oct. 2	
June 6	202	23	102		
13	160	30	128	The year	1

MYSTIC LAKE NEAR MEDFORD, MASS.

Location.—About 1½ miles west of Medford.

Drainage area.—26.9 square miles, including about 3 per cent of water surface.

Records available.—January, 1878, to December, 1897.

Determination of discharge.—Mystic Lake was used as a source of water suppl for the city of Charlestown from 1864 to 1897. The discharge was determined b making allowance for the storage in Mystic Lake and the water pumped for th city supply. The accuracy of the records is doubtful, as no allowance was mad for storage in other reservoirs in the basin, the slip of the pumps, nor the flow in fishway.

Cooperation.—Entire record furnished by the Metropolitan Water and Seweraд Board of Boston in the calendar-year form and changed to the climatic year b engineers of the Geological Survey.

ystic Lake basin near Medford, Mass., for the ept. 30, 1878–1897.

a, 26.9 square miles.]

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Mean.
3.81	4.26	1.98	1.87	0.70	0.42	0.96	0.50	......
2.24	2.87	3.56	1.69	.87	.47	.61	.43	1.59
2.36	1.69	1.34	.83	.46	.58	.47	.40	.91
2.06	5.89	1.95	1.31	1.84	.75	.30	.28	1.36
2.91	3.63	1.04	1.60	.73	.30	.19	.48	1.13
1.37	1.63	1.46	1.04	.47	.26	.19	.16	.71
3.61	4.71	3.45	1.28	.76	.50	.52	.21	1.45
1.74	1.78	1.82	1.89	.77	.41	.47	.30	1.03
7.39	3.39	2.90	1.10	.49	.36	.22	.29	1.91
3.47	3.12	3.36	1.64	1.14	.75	1.17	.43	1.68
3.08	3.71	2.93	2.50	.75	.34	.47	1.17	1.51
1.76	1.39	2.03	1.89	1.69	1.15	1.78	.95	2.32
2.14	4.66	2.63	2.60	1.72	.37	.40	.52	1.90
5.73	6.25	3.07	1.21	.91	.36	.38	.38	2.49
1.63	2.63	1.19	1.82	1.05	.57	.43	.50	1.14
2.05	3.92	2.44	3.83	.93	.41	.60	.37	1.44
1.80	2.65	2.03	1.14	.82	.43	.33	.32	1.08
.84	2.74	2.64	.98	.48	.52	.69	.32	1.05
3.15	3.90	2.92	.67	.67	.34	.29	.95	1.64
1.34	3.00	1.92	1.59	1.96	.43	.82	.37	1.29
......	......	......	......	......	......	......	......	......

stic Lake basin near Medford, Mass., for the years Sept. 30, 1879–1897.

ge area, 26.9 square miles.]

	Average yield per square mile.	Run-off.		Rainfall.[a]
		Depth in inches on drainage area.	Per cent of rainfall.	
	Sec.-ft.			*Inches.*
....	0.71	0.82	20.6	3.98
....	1.16	1.29	34.0	3.79
....	1.40	1.61	46.4	3.47
....	1.75	2.02	48.0	4.21
....	2.67	2.80	69.3	4.04
....	3.35	3.86	103.8	3.72
....	2.35	2.62	86.8	3.02
....	1.61	1.86	51.1	3.64
....	.97	1.08	33.8	3.20
....	.49	.56	15.6	3.58
....	.54	.62	15.5	4.00
....	.46	.51	16.1	3.17
....	1.45	19.65	44.8	43.82

Average for 20 years, 1878–1897.

MERRIMACK RIVER BASIN.

GENERAL FEATURES.

Merrimack River is formed near Franklin, N. H., by the union of Pemigewasset and Winnepesaukee rivers. The Winnepesaukee is a short stream flowing southwestward from Lake Winnepesaukee; the Pemigewasset, generally considered the head of the main stream, is the outlet of Profile Lake in Franconia, N. H., 50 to 60 miles north of Franklin and less than 10 miles from Mount Washington. From Franklin the Merrimack flows southward about 60 miles, crosses into Massachusetts, and a few miles below the State line, as it approaches the city of Lowell, turns abruptly to the east and flows easterly and northeasterly to the ocean at Newburyport. Its total length, including the Pemigewasset, is about 165 miles, of which 47.5 miles is in Massachusetts. Of its 5,015 square miles of drainage area, about 1,200 square miles is in Massachusetts, 211 square miles lying in the Nashua, Sudbury, and Lake Cochituate drainage areas, from which water is permanently diverted for the supply of the metropolitan district adjacent to Boston. A view of the Wachusett reservoir of this system is given in Plate XI.

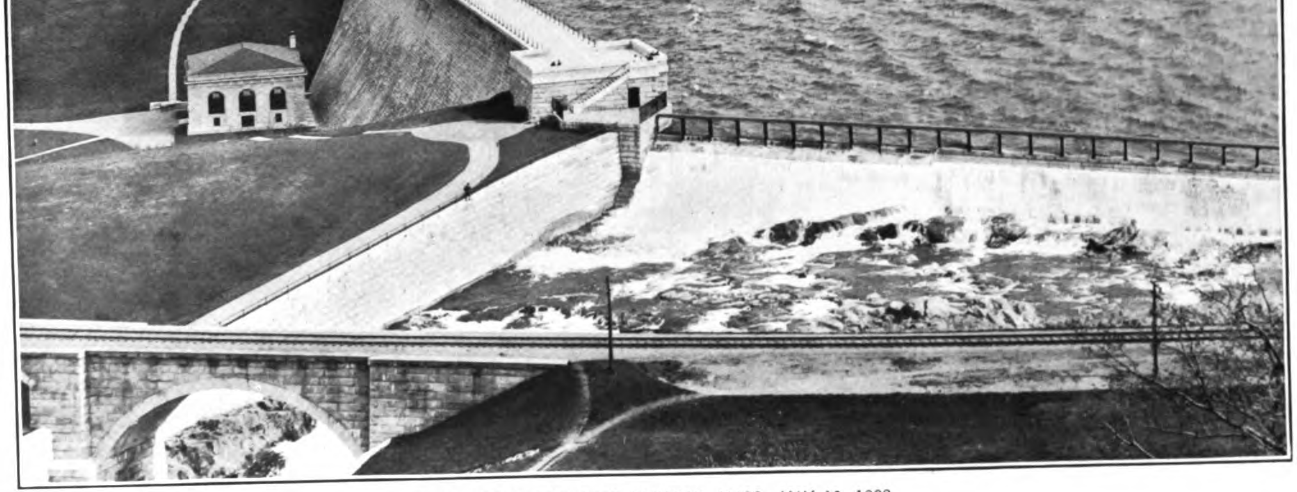
Important tributaries of the Merrimack, other than the headwater streams, are Contoocook, Suncook, Piscataquog, Souhegan, and Nashua rivers. Nashua River lies nearly all in Massachusetts but enters the Merrimack near Nashua, N. H. The other tributaries mentioned are all in New Hampshire.

The headwaters of the Pemigewasset reach an elevation approximately 2,000 feet above the sea; at Franklin the river is at an elevation of about 270 feet. The upper part of the basin is rough and mountainous and very largely in forest. Below Franklin the country is more uniform in topography and much of it is farm land.

The main river flows in reaches of moderate slope separated by falls over rock ledges. It is navigable as far as Haverhill, and for small boats as far as Lawrence.

The mean annual rainfall in this basin is about 42 inches, ranging from about 46 inches at Lowell to about 38 inches at Plymouth, but is probably much greater in the mountainous regions near the head of the Pemigewasset than elsewhere in the area. During the winter the streams are generally frozen, and especially in the northern parts of the region there is usually a heavy fall of snow.

The basin of the Merrimack is well supplied with natural facilities for storage, the combined area of lakes and ponds amounting to approximately 183 square miles. About 105 square miles of this is contained in Lake Winnepesaukee—next to Moosehead Lake the largest body of water in New England—which has about 4 feet of



WACHUSETT DAM NEAR CLINTON, MASS., MAY 12, 1908.

corresponding to somewhat less than

)11, provides that between June 1 and
nore than an average of 250 second-feet
om the lake when the level is 21 inches
ined from 1860 to date it appears that
led is 44 inches, which occurs when the
been recorded during 30 years since
stage was – 11¼ inches and occurred in
orded range thus being 55¼ inches.
to the Pemigewasset through Squam
15 square miles in area. This lake can
Newfoundland Lake, with half the water
tributary to the Pemigewasset. It can

lakes and on numerous smaller ones is
power on the river and greatly improves
w. In a general way, the most favorable
the Merrimack are being utilized, but in
nage basin there are still many unutilized

famous for its developed water powers.
Manchester are great industrial centers,
and woolen manufactures, and owe their
vater power available at their sites. There
remaining for power development on the
tributaries, especially the Pemigewasset
s a large amount of unutilized fall. Records
en mills were running have been kept at
Run-off records showing the mean daily flow
extend back to 1879; the driest year was
)0–91; the total flow during these two years
1 to 2.72.
rimack River and some of its principal tribu-
ollowing table:

rea of Merrimack River and tributaries.

	Drainage area.	River.	Locality	Drainage area.
	Sq. miles.			*Sq. miles.*
......	5,015	Winnepesaukee	Junction with Pemigewasset.	435
......	4,664			
......	4,127	Contoocook....	West Hopkinton......	410
......	2,340	Do.........	Mouth................	750
m.....	1,460	Suncook.......	East Pembroke........	250
....	615	Do.........	Mouth.................	270
Vinne-	1,085			

MERRIMACK RIVER AT LOWELL, MASS.

Location.—At the Boott Mills in Lowell.

Drainage area.—4,097 [1] square miles above Pawtucket dam. March 7, Metropolitan Water Board [2] of Boston diverted the flow of South Nashua River, which reduced the drainage area 118 square miles.

Records available.—January 1, 1848, to May 31, 1861; March 1, 1866, to S 30, 1915.

Gage.—Vertical staff in three sections on right bank. Low-water section to rollway wall, upper section to foundation wall of Boott Mills. Gage a day at approximately 10.45 a. m.

Determination of discharge.—Rating curves (Pl. XII) determined from of water flowing through the canals and water wheels, and leaking an over Pawtucket dam at various stages. Tables show only the flow for th during which mills were operating.

Channel and control.—Bed of stream smooth and regular; right bank mill wall over half a mile long; left bank high and rarely overflows ev spring floods. Control probably at "Hunts Falls," a short distance belo Control has been altered at various times by removal of ledge rock, bowl other material. During recent years zero flow occurred at gage height 38.5 feet, referred to datum of gage owned by the Proprietors of Locks an on Merrimack River.

Extremes of discharge.—Maximum stage recorded 1848–1915: 64.20 feet, 1852; discharge, 83,000 second-feet. Practically zero flow on nights, and holidays during low-water season, as water is stored above dam when not in operation.

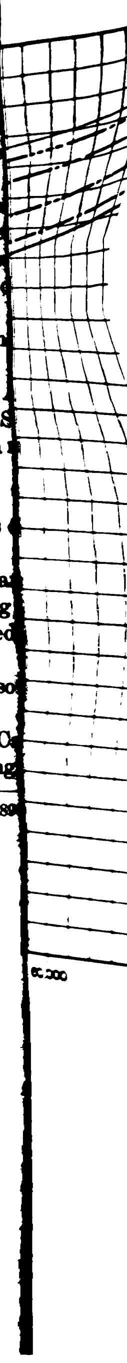
Winter flow.—Discharge relation only slightly affected by ice.

Diversions.—Almost the entire flow of South Branch of Nashua River is for water supply of metropolitan district of Boston.

Regulation.—Practically the entire low-water flow is regulated by dams a above station. Tables of discharge show only the 10-hour flow during when mills are in operation. In very dry seasons entire flow is store nights, Sundays, and holidays.

Accuracy.—Record considered reliable, although rating for earlier years is so uncertain.

Cooperation.—Entire record furnished by the Proprietors of Locks and C Merrimack River, Lowell, Mass., through Arthur T. Safford, assistant eng



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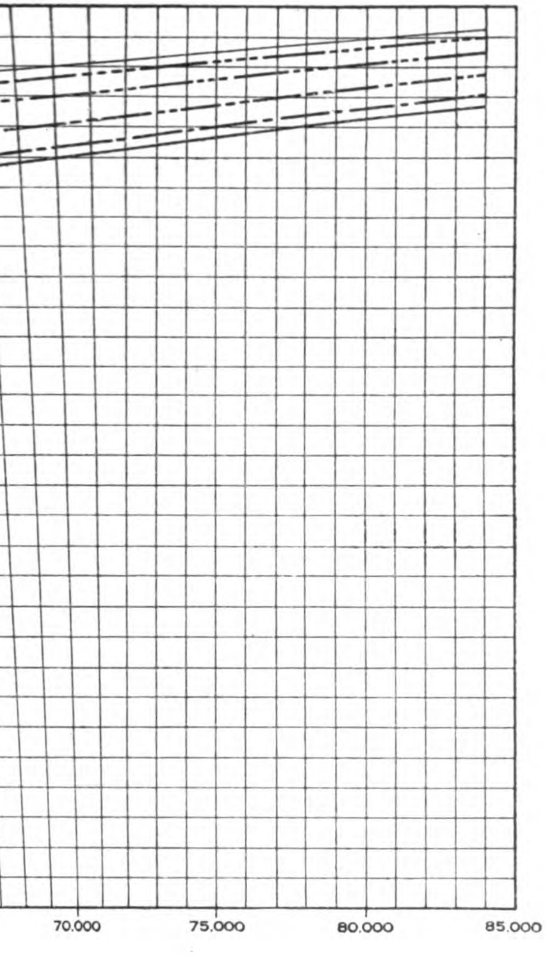
[1] Examination of water supplies: Mass. State Board of Health Rept., pt. 1, p. 442, 18

[2] Metropolitan Water Board Fourth Ann. Rept., p. 15, Jan. 1, 1899.


70,000
75,000
80,000
85,000

eet, of Merrimack River at Lowell, Mass., for the years
Sept. 30, 1848–1861; 1866–1915.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	7,700	5,790	16,625	6,500	12,560	5,140	4,860	5,020
.	7,860	5,360	....	6,850	10,730	....	4,780	4,640
	7,075	4,900	17,340	8,720	9,275	5,220	5,500	....
	6,975	5,060	13,625	17,100	....	....	5,200	4,560
	6,650	....	12,010	20,900	7,860	6,250	4,520	4,400
	....	5,280	....	15,850	7,700	6,600	....	4,480
	7,075	4,820	11,740	....	8,025	5,950	4,480	4,400
	7,075	5,060	10,500	13,470	8,275	5,600	4,400	4,360
.	6,460	5,950	....	13,140	8,780	....	4,440	4,360
0	6,340	9,000	8,840	11,740	8,500	5,060	4,240	....
5	6,500	9,425	8,560	11,175	....	4,980	4,140	4,400
5	6,300	....	8,600	15,990	7,175	4,860	4,240	4,280
0	....	9,675	8,660	18,860	6,790	4,820	....	4,240
5	5,950	9,100	8,900	....	6,500	5,240	4,320	4,060
0	6,125	8,275	10,270	14,150	5,790	5,200	4,240	4,060
..	6,075	7,820	....	14,470	5,950	....	4,140	4,020
0	5,790	7,175	9,625	12,900	5,750	5,140	4,140	....
0	5,240	6,890	9,150	13,995	....	4,820	4,100	4,740
0	5,360	....	8,900	10,390	5,500	4,560	4,360	4,740
25	....	6,500	8,660	9,525	5,600	4,480	....	5,870
50	5,400	7,600	8,900	....	6,075	4,320	9,525	5,950
75	5,600	11,500	8,275	9,475	6,500	4,160	6,975	5,360
...	5,990	13,675	....	11,300	6,125	....	5,790	5,320
90	6,420	13,020	7,860	11,500	5,790	4,400	5,140	....
30	6,550	11,400	7,860	10,500	....	4,480	4,900	4,860
40	6,125	....	7,820	9,900	5,280	4,640	4,780	4,780
00	....	10,050	7,600	9,325	5,060	4,600	....	4,780
50	5,600	10,850	7,075	....	4,900	4,560	4,640	4,860
75	5,600	12,700	6,790	8,600	4,980	5,240	4,640	4,740
...	....	16,425	....	8,175	5,060	....	4,560	4,600
40	....	17,280	....	8,720	....	5,240	4,600	....

ec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,225	6,750	6,125	4,940	....	7,700	8,325	....	4,280	4,700
,950	6,420	5,870	4,980	25,100	7,500	9,825	4,820	4,240	....
.....	7,375	5,500	4,980	17,995	7,175	....	4,740	....	5,060
,420	7,500	....	....	14,250	7,175	8,540	....	4,240	4,900
,225	8,325	5,400	4,980	12,800	6,700	9,000	4,780	....	4,740
,550	9,100	5,500	4,820	12,800	....	10,150	4,740	4,320	4,560
,275	....	5,320	4,900	13,410	7,175	8,900	4,740	4,280	4,560
,100	8,660	5,870	4,980	....	6,890	7,860	....	4,140	4,560
,100	6,850	5,240	4,980	10,500	6,700	7,175	4,740	4,140	....
.....	6,650	5,790	5,060	10,270	6,700	....	4,560	4,140	5,060
,575	6,790	....	....	9,950	6,790	6,700	4,560	4,240	4,780
,025	6,975	5,400	4,820	....	6,700	6,340	4,400	....	4,560
,150	6,700	6,125	4,820	9,725	....	6,125	4,360	14,590	4,480
8,900	....	5,450	4,900	9,100	7,780	5,950	4,240	13,855	4,520
8,420	5,950	5,400	5,060	....	14,350	5,690	....	10,790	4,520
8,025	6,340	5,400	5,400	8,275	15,220	5,600	4,560	8,720	....
.....	6,340	5,400	5,400	7,860	11,450	....	4,400	7,700	4,480
8,460	6,500	....	....	7,600	9,625	5,320	4,400	6,500	4,400
8,660	6,650	5,240	5,790	7,600	8,900	5,140	4,400	....	4,400
8,275	6,600	5,060	5,870	8,075	....	4,900	4,360	5,790	4,400
7,900	....	5,060	7,175	8,460	7,860	4,820	4,320	5,600	4,280
7,700	5,600	4,560	11,740	....	7,500	4,820	....	5,240	4,120
5,950	5,320	4,560	14,980	7,860	7,600	4,740	4,400	4,900	....
.....	5,160	4,560	14,200	7,700	7,375	....	4,360	5,450	4,400
.....	5,060	....	....	7,700	7,500	4,780	4,360	6,500	4,240
6,790	5,400	4,900	11,175	8,540	8,275	4,700	4,320	....	4,400
7,600	6,250	4,860	13,080	8,075	....	4,740	4,320	5,790	4,440
7,175	....	4,900	13,080	7,550	7,375	4,700	4,240	5,320	4,400
6,930	7,275	....	16,250	....	6,975	4,740	....	4,980	4,280
6,790	6,930	....	20,185	7,700	6,700	4,700	4,400	4,940	....
.....	6,890	....	26,600	....	7,075	....	4,320	4,740	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the yea ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1849–50.												
1	4,480	11,300	7,700	6,340	7,075	8,420	8.075	40,150	17,820	8,600	6,075	......
2	4,480	10,330	......	6,300	7,225	8,325	8.900	26.200	......	8,275	6,790	5,7
3	4,480	7,600	7,700	6.030	......	......	10.270	18.780	14,150	8,175	6,890	6.0
4	4,480	......	7,075	5.910	7,500	8,125	13.525	15.220	13,020	......	......	12.2
5	4,560	6,600	6,600	5,910	7,550	7,075	23,100	......	12,175	10,675	7,950	13,3
6	4,640	6,500	7,125	......	7,450	7,075	22,500	16.250	11,250	9,275	8,900	11.3
7	......	6,600	7,125	6,225	6,700	8,225	......	33,300	10,500	......	8,075	9,4
8	7,275	6,600	6,340	5,600	6,600	9,475	15,100	32,200	9,775	7,075	7,125	......
9	9,200	6,975	......	5,690	6,125	8,900	14,470	23.500	......	6,500	6,380	12.8
10	8,275	16,250	6,300	5,690	......	......	14,150	22,900	9,675	6,125	5,950	12,2
11	7,860	......	6,340	5,830	11,500	8,175	......	24,000	11,950	5,830	......	10,7
12	10,850	32,700	6,420	5,910	15,610	7,950	11,620	......	14.980	5,600	5,870	9.2
13	15,550	23,000	6,225	......	16,625	7,700	11,300	15,610	12,750	5,400	5,500	8,3
14	......	16,625	5,910	6,890	14,250	8,425	......	13,995	10,730	......	5,600	7,7
15	10,050	13,525	5,910	6,700	13,525	12,010	11,075	12,850	9,525	5,500	7,175	......
16	8,660	11,620	......	6,500	12,900	14,590	10,625	13,575	......	5,400	7,275	6,8
17	7,700	10,390	6,125	6,225	......	......	10,150	16,130	8,175	5,790	6,700	6,6
18	7,075	......	6,380	6,075	10,675	13.140	9,625	15,990	7,780	5,910	......	6.4
19	6,700	8,780	6,420	5,950	10,270	11.800	9,325	......	7,375	5,450	5,690	6,2
20	6,340	9,425	6,380	......	9,525	10,730	9,525	12,380	7,375	5,910	5,550	6,2
21	......	14,350	6,500	5,650	9,525	9,325	......	12,010	6,975	......	5,320	6,0
22	5,950	15,610	6,790	6,500	9,100	9,050	9,900	15,040	6,650	14,980	5,240	......
23	6,030	12,900	......	7,550	8,720	9,050	11,175	16,695	......	10,790	5,020	5,8
24	6,340	11,125	7,275	7,900	......	......	13,575	15,340	7,500	8,440	4,900	5,8
25	6,100	......	......	8,025	7,900	8,500	14,470	14,410	8,075	7,375	......	5,5
26	5,950	9,625	6,500	7,860	7,860	8,225	13,855	......	7,740	6,650	7,275	5,3
27	5,790	9,275	6,650	......	8,275	7,780	14,920	17,400	7,225	6,125	10,625	5,3
28	......	8,780	6,600	8,025	8,420	7,860	......	24,500	6,850	......	10,150	5,9
29	5,550	......	6,420	7,900	......	7,860	24,800	24,500	6,890	5,690	8,325	......
30	5,790	8,075	......	8,125	......	7,780	29,400	22,500	......	5,400	7,175	6,2
31	8,600	......	6,175	7,700	......	......	......	20,030	......	5,750	6,460	......
1850–51.												
1	5,830	7,550	......	5,910	7,500	14,150	13,140	9,325	......	5,060	3,620	4,4
2	5,200	6,975	9,950	5,950	......	......	15,160	10.270	7,550	5,020	3,340	4,4
3	5,790	......	8,500	5,600	5,910	12,275	13,855	10,450	6,930	5,060	......	4,3
4	6,380	6.420	7,860	5,790	5,790	11,025	13,925	......	6,550	......	4,900	4.2
5	7,500	6,225	8,025	......	5,500	10,390	13,020	9,100	6.175	6,550	4,780	4,2
6	......	6,125	7,900	5,750	5,450	10,270	......	9,950	5,790	......	4,740	3,9
7	6,380	5,950	7,700	5,360	5,990	10,330	11,300	10,850	5,240	6,930	4,640	......
8	5,950	5,750	......	5,910	5,830	10,100	12,960	10,390	......	5,990	4,640	4,2
9	5,690	5,600	6,700	5,550	......	......	13,260	9,625	5,990	5,750	4,600	4.2
10	5,600	......	6,500	5,320	6,030	9,100	......	9,200	8,225	5,790	......	4,2
11	5,320	5,360	6.030	5,450	5,830	8,780	14,530	......	9,525	5,600	4,900	4,1
12	5,240	5,240	5,950	......	7,780	8,840	12,225	9,275	8,500	5,500	4,780	4,0
13	......	5.240	5,910	5,650	9,275	8,500	......	10,390	7,500	......	4,860	4,0
14	5,060	5,100	5,910	5,600	10,270	7,900	10,270	10,970	6,930	5,240	4,820	......
15	4,980	5.060	......	5,550	10,575	7,950	9,725	11,350	......	4,980	5,140	4,3
16	4,940	5,060	5,500	5,500	......	......	11,740	10.450	5,870	4,980	4,900	4,3
17	4,900	......	5.690	5,600	18.550	7,950	19,020	9,325	6,550	4,900	......	4,2
18	4,740	5,910	6,460	5,790	19,400	7,900	20,185	......	6,340	4,820	4,780	4,1
19	4,820	6,500	5,950	......	16,275	7,550	17,750	8,900	6,340	4,640	4,560	4,0
20	......	6,340	5,500	5,750	13,470	7,550	......	8,540	6,200	......	4,480	3,7
21	5,320	5,870	5,690	5,600	12,380	7,780	15.340	8,175	5,950	6,600	4,400	......
22	5,400	5,650	......	5,450	15,100	7,925	16,130	8.275	......	6.650	4,400	4,2
23	5,140	5.400	5,690	5,400	......	......	15.280	8.780	5,950	5,650	4,520	4,2
24	5,060	......	5,770	5,320	16,625	9,275	13,575	8,275	5,600	5,200	......	......
25	4,940	5,240	......	5,280	15,850	10,150	12,325	......	6,850	4,980	5,020	4,2
26	4,940	5,060	5,990	......	17,750	10,550	11,300	7,375	6,790	4,820	4,900	4,1
27	......	5,060	5,600	5,550	16,625	10,050	......	6,790	6,225	......	4,820	4,0
28	13,525	......	5,690	5,600	14,890	10,150	9,850	6,890	5,950	4,940	4,640	......
29	12,850	6,750	......	5,450	......	11,450	9,425	7,075	......	4,900	4,560	4,3
30	10,050	8,660	5,950	6,340	......	......	9,275	5,650	5,240	3,590	4,440	4,2
31	8,540	......	6,030	7,125	......	12,325	......	6,075	......	3,620	......	......

Merrimack River at Lowell, Mass., for the years
3–1861; 1866–1915—Continued.

		Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
		....	7,075	9,950	18,490	8,720	4,900	....	8,275
		5,990	6,460	10,390	....	8,325	4,980	4,640	6,600
		6,030	6,850	10,625	16,625	7,860	5,790	4,640	5,690
		5,790	6,890	....	15,400	6,340	....	4,680	5,360
		5,600	6,030	9,375	14,920	6,380	....	4,640	....
	0	5,600	5,950	9,000	14,250	....	5,750	4,640	5,100
	25	5,650	....	9,375	14,470	5,990	5,320	4,560	4,900
	00	....	5,790	....	15,400	5,790	5,140	....	4,640
	80	5,830	5,950	9,825	....	5,830	4,860	4,780	4,560
	20	5,690	6,790	10,150	16,890	6,225	4,820	4,820	4,560
	..	5,790	8,500	....	16,375	8,325	....	4,780	4,440
	60	7,225	9,625	11,300	14,710	6,750	4,740	4,740	....
	700	9,375	10,330	12,175	14,590	....	4,740	4,600	4,860
	275	11,450	....	11,740	16,060	5,830	4,740	4,440	5,870
	225	....	14,590	12,010	15,100	....	4,740	....	5,750
	175	10,000	16,485	15,340	....	5,360	4,560	4,740	5,280
	,890	9,275	16,375	16,200	12,750	5,240	4,560	4,560	5,100
	....	8,375	15,100	....	12,225	5,320	....	4,480	4,900
	,075	7,950	13,140	18,250	12,900	5,240	4,780	4,400	....
	,225	7,450	11,680	27,400	11,680	....	4,740	4,400	4,900
	,375	7,025	....	42,500	10,270	5,320	4,660	4,280	4,860
	,420	....	9,525	68,500	9,625	5,240	4,520	....	4,740
	8,500	6,380	9,200	71,000	....	5,240	4,640	4,480	4,740
	8,420	6,340	8,950	54,500	9,000	5,600	4,400	4,520	4,740
	......	6,340	9,275	....	9.050	5,750	....	4,440	4,560
	6,975	6,500	9,100	27,700	8,500	5,360	4,520	4,600	....
	6,550	6,790	9,100	24,800	8,275	....	4,600	4,600	4,900
	6,340	6,750	....	25,800	8,025	5,240	4,560	6,075	4,780
	5,950	....	11,025	25,500	7,225	....	4,480	....	4,740
	5,830	....	11,250	20,980	....	4,860	4,400	6,700	4,860
	5,790	....	10,450	....	8,275	....	4,360	7,740	....
	9,725	5,950	10,730	12,010	....	10,390	4,700	4,820	5,280
	....	5,600	9,675	13,525	9,325	9,525	4,560	4,900	5,120
	8,720	5,790	9,675	....	8,275	8,840	....	4,780	4,940
	8,225	6,340	9,275	12,440	7,700	8,325	....	5,320	....
	7,820	7,075	8,540	13,725	7,325	....	4,600	5,550	5,060
5	7,550	....	....	17,220	7,375	7,700	4,640	5,240	5,200
5	6,890	14,920	8,275	....	8,900	7,325	4,600	....	5,060
5	6,850	32,200	8,325	14,590	....	6,975	4,560	5,450	5,020
0	....	22,000	8,275	12,900	8,900	6,700	4,480	5,360	4,820
25	6,890	15,610	8,840	....	10,970	6,700	....	5,320	4,640
00	6,890	12,700	9,325	13,260	10,850	6,460	4,560	5,140	....
..	6,975	10,850	9,150	12,225	10,100	....	4,600	5,060	4,940
50	6,700	....	....	11,450	10,730	6,225	4,640	4,940	4,900
75	6,500	7,450	9,000	11,125	9,375	5,950	4,640	....	4,740
50	6,460	7,550	8,780	13,080	....	5,690	4,600	5,690	4,860
225	....	7,600	7,860	12,800	7,860	5,600	4,560	5,750	3,340
340	7,275	8,660	7,700	....	7,820	5,500	....	5,790	7,075
700	6,460	10,450	7,700	10,850	8,500	5,500	4,600	5,550	....
....	6,340	10,390	9,200	10,390	8,460	5,500	4,560	5,870	7,075
,075	5,870	....	....	9,900	9,325	5,400	4,600	6,300	6,975
,175	5,870	8,420	9,725	9,725	10,625	5,140	4,640	....	6,700
,790	5,690	7,860	12,070	9,825	....	5,100	4,640	6,930	7,820
,700	....	8,660	14,590	11,075	8,125	5,100	4,640	6,340	9,425
,340	6,125	17,995	15,400	....	7,650	5,100	....	5,600	8,025
.....	6,700	19,645	13,925	12,010	7,860	4,820	4,780	5,120	....
.....	7,125	18,065	12,225	10,500	10,390	....	4,600	5,120	6,340
8,375	6,890	....	....	9,525	20,940	4,900	4,640	4,980	5,950
8,660	6,340	11,740	10,625	8,900	25,900	4,900	4,640	....	6,075
9,050	5,790	....	10,210	8,840	....	4,740	4,600	5,550	7,075
10,450	....	....	9,825	9,900	13,855	4,820	4,400	5,790	9,425
10,850	5,790	....	10,390	....	11,680	....	....	5,600	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the yea ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1853–54.												
1	8,325	9,525	7,820	......	5,910	8,275	7,175	34,300	7,740	5,240	4,700	4,60
2	......	8,720	7,860	5,450	5,830	8,125	......	38,800	7,075	......	4,660	4,40
3	6,700	8,275	7,650	5,830	5,790	7,860	8,325	30,900	7,075	5,320	4,660	......
4	6,340	7,880	......	5,600	6,250	7,860	8,275	25,000	......	......	4,660	4,70
5	6,125	7,325	6,600	5,600	......	......	8,125	26,900	6,650	5,100	4,560	4,66
6	6,030	......	6,175	5,790	5,790	7,700	......	26,200	6,340	5,060	......	4,60
7	5,870	6,750	6,340	5,950	5,990	7,550	12,440	......	5,830	5,020	4,780	4,74
8	5,600	6,700	6,125	......	5,790	7,325	17,925	17,400	6,125	4,900	4,660	4,74
9	......	6,600	5,950	5,910	5,830	7,700	......	15,100	7,325	......	4,600	4,74
10	5,600	5,750	5,910	5,950	6,300	8,600	15,400	13,470	8,175	4,980	4,560	......
11	5,600	12,960	......	5,550	7,225	9,950	14,920	12,700	......	4,900	4,560	5,79
12	5,550	10,675	6,030	5,400	......	......	14,920	13,410	8,420	4,820	4,520	5,95
13	5,550	......	5,950	6,225	6,700	12,650	15,040	13,470	7,325	4,780	......	5,24
14	5,500	14,150	5,950	9,325	6,340	13,725	15,040	......	6,750	4,820	4,740	5,14
15	5,400	24,100	5,830	......	6,340	13,470	14,100	12,380	6,600	4,700	4,660	5,10
16	......	18,250	5,790	10,625	6,500	13,140	......	17,010	6,500	......	4,660	5,02
17	5,280	13,855	5,790	8,950	6,550	20,500	11,500	15,670	6,340	4,900	4,600	......
18	5,280	12,010	......	8,070	6,380	21,220	11,125	12,700	......	4,660	4,560	4,98
19	5,240	12,010	5,990	7,550	......	......	10,575	13,675	5,950	4,560	4,560	4,90
20	5,100	......	5,950	7,075	6,300	14,530	10,790	22,500	5,830	4,520	......	5,02
21	5,060	11,500	5,870	6,810	5,830	12,070	12,175	......	5,790	4,560	4,660	4,94
22	5,100	12,225	5,500	......	5,950	10,390	13,410	13,855	5,600	4,520	4,560	4,90
23	......	11,950	5,320	7,550	5,710	9,775	......	12,560	5,450	......	4,660	4,86
24	9,325	......	6,125	7,700	6,125	9,675	14,350	11,250	5,360	4,980	4,660	......
25	12,225	10,150	......	7,500	5,790	9,100	14,800	10,210	......	4,940	4,560	4,94
26	19,645	9,325	5,450	7,400	......	......	13,995	9,775	5,400	4,940	4,440	4,90
27	14,350	......	5,360	6,700	6,420	8,175	14,200	10,675	5,280	4,900	......	4,86
28	11,620	8,075	5,870	6,250	7,500	7,860	16,950	......	5,280	4,940	4,600	4,78
29	13,140	7,700	5,320	......	......	6,930	26,400	9,525	5,240	4,900	4,600	4,86
30	......	7,550	5,240	7,075	......	9,575	......	8,660	5,240	......	4,600	4,86
31	11,125	......	5,690	6,500	......	9,575	......	8,275	......	4,900	4,480	......
1854–55.												
1	......	4,940	9,325	6,125	17,750	6,890	......	12,900	5,650	......	5,950	5,140
2	4,900	5,200	8,460	6,125	14,860	6,650	10,100	12,900	5,790	6,750	5,870	......
3	4,860	5,710	......	5,750	12,500	6,650	10,150	14,350	......	6,250	5,870	5,060
4	4,820	5,320	7,500	5,650	......	......	10,050	13,410	7,975	......	5,550	5,100
5	4,740	......	6,810	5,710	10,730	6,600	......	12,325	9,150	5,790	......	5,140
6	4,740	5,240	6,460	5,790	9,225	7,325	10,450	......	9,725	5,790	5,320	5,060
7	4,660	5,060	6,700	......	8,325	8,600	16,485	10,910	7,780	6,500	5,320	5,020
8	......	5,020	7,450	5,990	7,820	9,050	......	10,500	7,075	......	5,280	4,940
9	4,900	5,240	7,900	6,890	7,700	8,420	17,220	10,000	10,625	6,810	5,400	......
10	4,860	4,900	......	7,025	7,740	7,860	16,425	9,900	......	7,325	5,710	5,400
11	4,820	4,860	6,850	6,930	......	......	16,485	9,525	8,560	6,700	6,420	5,020
12	4,740	......	6,930	6,500	7,500	7,225	17,680	9,000	13,200	6,500	......	4,980
13	4,740	14,030	7,075	6,340	7,125	6,975	17,400	......	12,380	7,075	5,750	4,940
14	4,740	15,040	6,700	......	6,750	6,850	15,850	7,820	9,575	6,750	5,400	4,980
15	......	15,610	6,600	6,650	7,450	6,700	......	8,075	8,275	......	5,400	5,020
16	5,140	11,350	6,500	5,870	13,855	6,750	15,730	8,275	7,600	6,340	5,240	......
17	5,140	9,275	......	5,910	15,790	6,930	17,010	8,500	......	5,910	5,320	5,020
18	5,400	8,275	6,650	5,790	......	......	20,740	10,150	6,850	5,600	5,140	4,980
19	5,320	......	6,975	6,250	14,150	7,025	24,800	9,000	6,300	5,500	......	5,060
20	5,200	6,930	6,750	6,420	12,440	7,075	27,700	......	6,125	5,100	5,140	5,060
21	5,100	6,750	6,500	......	11,025	7,075	33,600	7,650	6,125	5,280	5,140	5,020
22	......	6,500	6,340	7,600	10,150	7,025	......	7,500	6,250	......	5,060	4,940
23	5,200	6,460	6,340	11,125	9,525	6,975	26,400	7,075	6,300	5,400	5,020	......
24	4,980	6,340	......	15,280	9,675	6,850	22,900	6,250	......	5,240	4,980	5,060
25	4,940	6,700	......	17,400	......	......	20,185	6,420	7,075	4,980	6,125	4,980
26	4,900	......	5,830	14,860	8,660	6,810	19,715	6,550	7,600	5,060	......	5,020
27	4,860	19,645	5,830	12,500	7,450	6,700	19,470	......	9,050	5,550	5,750	4,980
28	4,820	13,200	5,950	......	7,025	6,600	19,100	6,250	9,325	5,830	5,450	5,060
29	......	10,450	6,300	11,740	......	6,700	......	6,030	8,375	......	5,280	5,020
30	4,940	......	6,460	14,470	......	6,600	13,410	5,910	7,650	6,340	5,240	......
31	5,020	......	......	17,400	......	7,275	......	5,750	......	5,950	5,200	......

Merrimack River at Lowell, Mass., *for the years*
8–1861; 1866–1915—Continued.

		Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	0	6,260	4,900	5,600	9,525	....	5,400	4,520	9,325
	00	6,030	....	5,710	8,950	7,740	5,240	4,480	8,075
	20	....	5,060	6,030	9,100	7,275	5,240	....	7,225
	60	6,930	4,980	7,175	....	7,075	....	4,560	6,700
	00	6,750	5,060	9,100	9,825	7,175	5,200	4,560	6,460
	..	6,700	5,600	....	9,100	7,175	....	4,860	6,250
	975	6,340	5,140	14,100	8,375	7,275	5,360	11,740	....
	500	6,340	5,060	16,765	7,900	....	5,280	17,995	5,910
	890	6,125	....	18,250	7,860	7,600	5,200	14,470	5,990
	500	....	6,300	....	10,100	7,450	5,060	....	6,075
	400	6,340	6,340	21,965	....	7,275	4,980	12,440	6,030
	500	6,030	5,750	19,160	14,800	7,075	4,940	10,390	5,910
	....	6,890	5,600	....	13,625	6,600	....	8,600	5,870
	,275	6,700	....	14,350	11,740	6,420	5,240	7,650	....
	,890	6,460	5,320	13,080	10,450	....	5,200	6,850	5,950
	,890	6,075	....	11,500	9,425	6,075	5,200	6,500	5,870
	,420	....	5,400	10,450	9,100	5,950	5,060	....	5,790
	,340	6,600	5,320	10,500	....	5,790	4,820	5,950	5,650
	,250	6,340	5,240	10,730	8,900	5,790	4,900	5,790	5,710
	......	6,125	5,320	....	8,660	5,830	....	5,870	5,650
	6,650	5,990	5,240	12,700	9,050	5,790	4,900	6,340	....
	6,500	5,950	5,240	16,375	9,275	....	4,860	17,160	5,990
	6,420	5,950	....	19,100	8,225	5,550	4,700	17,280	6,250
	6,340	....	5,500	18,490	7,650	5,500	4,660	....	6,750
	6,340	5,990	5,500	15,340	....	5,400	4,480	10,625	7,500
	6,890	6,030	5,600	13,410	7,780	5,400	4,400	9,525	7,275
	....	5,950	5,910	....	7,700	5,360	....	8,375	6,850
	6,250	5,910	5,950	10,850	7,400	5,280	4,560	7,650	....
	6,175	5,060	5,950	10,100	8,025	....	4,560	7,075	6,300
	6,075	....	....	10,150	8,660	5,320	4,520	8,225	6,030
	6,340	....	5,600	....	8,900	....	4,480	....	....
	5,910	....	....	9,275	11,740	10,270	5,750	6,460	9,100
	5,950	6,890	8,660	9,675	10,970	9,775	5,710	....	8,025
0	5,870	6,850	7,600	9,225	....	9,625	5,600	6,175	7,125
0	....	6,810	7,600	8,460	19,340	9,625	....	5,830	6,460
0	6,340	6,700	7,700	....	19,470	8,840	....	5,830	5,990
0	6,975	6,750	7,820	8,025	24,800	8,325	5,600	5,710	....
.	7,860	6,700	7,780	11,400	30,100	....	5,450	5,600	5,600
0	8,325	....	....	26,900	22,000	7,650	5,400	5,600	5,400
0	8,780	11,300	6,810	20,110	16,695	7,075	5,400	....	5,140
0	8,460	14,350	6,750	14,300	....	7,125	5,400	5,450	4,900
10	....	18,065	6,420	12,900	13,525	6,850	5,360	5,400	4,900
50	8,075	15,100	6,460	....	12,900	6,975	....	5,450	4,900
50	7,600	11,860	6,175	13,855	11,560	....	5,240	6,500	....
..	7,450	10,050	6,175	13,410	10,500	....	5,200	6,175	4,820
80	7,275	....	....	19,160	9,900	8,125	5,240	8,560	4,780
275	7,450	9,325	6,300	....	9,900	7,400	5,400	....	4,740
275	7,780	11,680	6,500	26,100	....	6,890	5,500	7,450	4,560
075	....	16,485	6,975	18,370	11,620	6,700	5,280	6,650	4,740
950	8,175	22,100	8,075	....	12,325	6,750	....	8,075	5,060
....	8,780	22,700	13,020	13,995	11,350	7,820	5,280	8,175	....
....	7,780	20,325	14,860	15,610	13,080	....	5,240	7,450	4,900
,780	7,450	....	....	17,680	17,010	8,075	5,870	11,450	4,820
,175	7,975	13,525	11,400	16,625	17,280	7,975	6,460	....	4,980
,860	8,275	12,175	10,210	15,160	....	9,950	7,820	8,375	5,140
....	....	11,740	9,675	14,470	13,020	10,000	8,600	9,000	5,360
7,325	7,780	13,140	9,675	....	11,800	8,275	....	8,500	5,950
7,125	7,860	12,225	9,900	12,750	11,025	7,275	7,820	7,325	....
.....	7,025	11,680	10,050	13,260	13,090	....	6,975	6,930	5,500
6,700	6,810	....	....	13,260	10,500	6,420	6,650	6,850	5,140
6,250	6,700	....	9,375	12,800	12,650	5,790	6,850	....	5,140
6,030	6,810	....	9,275	....	....	....	6,930	10,910	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the year ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1857–58.												
1	5,060	......	6,850	6,250	7,860	5,400	8,660	8,460	7,500	5,600	......	5,600
2	4.780	10,000	8,840	6,550	7,175	5,710	8.660	......	7,075	5,400	5,500	5.400
3	4,600	9,225	10,390	......	......	5,790	8,460	8,325	6,340	5,320	5,400	5.320
4	......	8,500	9,225	6,460	8,075	5,500	......	8,175	6,700	......	5,400	5,200
5	5,400	7,975	8,175	6,500	7,175	5,650	8,600	7,860	6,125	......	5,400	......
6	5,240	7,740	......	......	7,175	5,320	8,500	7,700	......	5,400	5,830	5,600
7	4,900	8,780	6,975	6,125	......	......	8,560	8,460	6,125	5,320	5,910	5,360
8	4.820	......	7,650	6,420	8,460	5,060	8,125	11,860	6,125	5,220	......	5,400
9	4,740	9,375	8,075	......	6,340	5,060	7,700	......	6,700	5,200	5,790	5,400
10	4,060	9,900	9,225	......	6,125	5,060	7,600	9,475	6,125	5,140	5,500	5,240
11	......	9,775	11,740	6,125	6,030	4,900	......	8,720	6,250	......	5,400	5,240
12	4,860	9,775	10,150	7,780	6,030	4,900	7,820	8,840	6,500	5,400	5,400	......
13	4,560	8.900	......	11,740	5,600	4,900	7,700	9,725	......	5,400	5,400	......
14	4,560	8,275	7,975	13,470	......	......	8,460	10,450	10,500	5,500	5,790	5,400
15	4,600	......	8,175	11,860	5,600	5,060	......	9,150	10,625	6,125	......	......
16	4,660	7,550	7,860	10,390	5,950	5,400	10,050	......	9,475	6,420	5,500	5,400
17	4,280	7,400	7,650	......	6,250	6,600	9,275	8,025	8,660	5,710	5,400	9,100
18	......	7,500	7,500	11,400	6,030	9,150	......	8,225	8,075	......	5,360	24,300
19	6,380	7,650	8,460	10,675	5,870	14,710	11,300	8,420	7,500	5,360	5.400	......
20	5,910	7,450	......	9,725	5,140	15,100	7,500	8,660	......	5,240	5,240	10,850
21	5,870	7,175	8,175	8,275	......	......	7,700	8.660	6,700	5,240	5,600	8.600
22	6,700	......	7,650	8,075	5,200	12,440	8,560	9,675	6.600	5,240	......	7,275
23	5.830	6,930	7,700	7,500	5,600	11,560	8,900	......	6,500	5.320	5,400	6,700
24	5,200	7,275	7,780	......	5,500	10.390	9,100	10,150	6.420	5,500	5,240	6,420
25	......	7,860	......	7,500	5,060	9,275	......	10,390	6,125	......	5,240	6,250
26	6,700	......	6,340	6,890	5,140	8,460	10,150	11,740	5,950	5,950	5,240	......
27	15,920	6,340	......	8,500	4,980	8,075	9,100	9.950	......	5,790	5,140	5,870
28	24.900	6,600	6,420	10,390	......	......	8,660	9,100	6,340	5,550	5,100	5,600
29	21.545	......	5,790	10.150	......	7,500	8.460	8,460	5,950	5.400	......	5.600
30	16,130	6,420	......	9,225	......	7,700	8,420	......	5,710	5,400	5,950	5,400
31	13,140	......	6,075	......	......	8,275	......	7,700	......	......	6,340	......
1858–59.												
1	5,400	10,625	5,950	5,550	7,075	6,750	23,650	......	6,890	6,700	5,060	4,980
2	5,600	9,625	5,400	......	6,700	6,975	18,940	13.625	6,890	6,460	4,980	5,060
3	......	8,275	5,400	5,950	6,500	6,550	......	12,750	6,810	......	5.060	4,980
4	8,275	7,500	5,600	5,790	6,340	6.340	15,990	12,700	6,930	......	4,980	......
5	7,075	7,075	......	6,125	6,340	6,300	15,340	11,740	......	8,125	......	5,020
6	6,700	7,500	5,790	5,790	......	......	14,150	11,500	7,700	7,275	5,060	4,900
7	6,125	......	5,600	5,600	5,950	6,500	......	12,225	7,075	6,700	......	4,900
8	5,870	9,000	5,870	5,870	5,950	7,075	12,125	......	6,600	6,250	......	4,900
9	5,790	9,725	6,125	......	5,870	7,700	11.740	12,850	6,420	5,950	4.980	4,900
10	......	9,050	6,125	7,075	6,300	8,075	......	12,560	6,500	......	4,980	4,820
11	5,870	8,375	5,500	8,175	7,500	7,860	10,625	13,925	6,810	5,790	4,900	......
12	5,600	7,700	......	8,660	7,500	7,900	10,850	12,960	......	5,500	4,900	4,940
13	5,500	7,050	5,600	8,460	......	......	11,300	11,300	6,700	5.400	4,900	4,900
14	5,790	......	5,600	......	7,275	11,950	11,740	10,150	6.380	5,600	......	4,900
15	5,790	6,380	5,500	6,890	6,600	14,590	12,800	......	6,300	5,790	5,060	4,900
16	......	6,125	6,500	......	6,420	21,220	13,625	9,525	6,125	5,600	4,980	4,900
17	......	5,870	7,175	6,340	6,340	30,600	......	8,660	5,950	......	4,940	4,900
18	6,500	6,340	7,975	6,125	6,420	28,900	13,625	8,175	6,975	5,400	4,900	......
19	6,125	6,125	......	5,950	6,500	32,900	13,140	8,075	......	5,240	4,900	5,060
20	5,950	5,790	5,950	6,125	......	......	12,560	9,225	9,325	5,240	4,900	4,940
21	5,950	......	5,950	5,950	7,175	42,400	12,275	10,730	9,100	5,200	......	4,980
22	5,790	5,910	5,950	7,780	8,025	31,100	12,175	......	11,075	5,140	4,900	5,060
23	5,600	5,790	6,250	......	7,900	24,500	12,325	11,740	11,250	5,060	4,900	5,950
24	......	5,790	5,790	10,625	7,900	21,140	......	11,680	10,050	......	4,860	7,500
25	7,700	......	......	10,000	7,700	19,790	14,350	10,150	8,950	......	4,900	......
26	8,900	5,950	......	8,950	7,700	22,900	13,785	9,000	......	5,100	5,140	6,340
27	7,700	5,790	5,710	8,275	......	......	15,610	8,460	8,840	......	5,710	5,750
28	6,810	......	5,870	7,860	6,890	18,250	18,250	7,975	8,075	5,280	......	5,400
29	6,500	5,790	6,340	7,500	......	17,040	16,625	......	7,275	......	5,400	5,320
30	6,125	5,600	6,125	......	......	18,610	14,710	7,400	6,890	5,140	5,240	5,240
31	......	......	6,175	7,500	......	25,800	......	6,810	......	......	5,060	......

Merrimack River at Lowell, Mass., for the years
-1861; 1866-1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	5,910	9,300	....	5,550	5,160	....	6,030	5,080
	6,440	10,730	7,675	5,400	6,300	5,200	5,750	....
	6,275	14,620	8,600	5,525	....	5,020	5,400	5,140
	6,010	....	8,125	5,500	6,600	....	5,280	5,040
	....	16,325	....	5,690	5,950	5,100	....	5,000
	5,550	13,750	7,780	....	5,990	5,060	5,080	5,000
	5,650	11,770	8,420	5,690	6,830	5,140	5,040	4,960
	5,910	10,575	....	5,690	6,770	....	4,960	5,160
	6,250	10,075	7,860	5,690	6,175	5,400	4,960	....
	6,075	9,450	8,420	5,600	....	5,450	5,080	5,425
	6,810	....	8,660	5,525	5,600	5,650	5,080	5,770
	....	7,900	8,420	5,425	5,240	5,690	....	5,525
	6,030	8,460	7,900	....	5,400	5,400	5,080	9,525
	5,525	8,325	7,650	5,360	5,280	5,280	5,120	9,250
	5,750	8,025	....	5,320	5,200	....	5,450	7,550
0	5,670	8,075	6,910	5,360	5,060	5,240	7,150	....
0	5,500	8.420	6,675	5,320	....	5,100	7,050	7,150
5	5,550	....	6,340	5,040	5,690	5,060	5,910	6,650
0	....	9,025	6,460	5,040	5,600	5,060	....	6,300
0	5,910	9,650	6,340	....	5,790	5,060	5,260	6,050
0	5,425	10,450	6,300	6,320	5,950	5,020	5,220	6,500
.	5,220	10,300	....	6,400	6,575	....	5,625	8.900
0	5,790	9,250	6,340	5,970	6,400	5,140	6,500	....
0	7,860	8,500	6,420	5,600	....	5,100	6,460	8,440
0	10,760	....	6,340	5,400	5,500	5,060	5,950	7,275
75	....	7,800	6,340	5,320	5,400	5,000	....	7,650
40	10,270	7,575	5,990	....	5,160	5,040	5,600	8,050
50	9,625	7,475	5,790	5,220	5,080	5,000	5,600	7,700
..	9,450	7,325	....	5,080	5,080	....	5,600	7,125
50	....	7,250	5,690	5,040	5,080	5,140	5,320	....
00	....	7,100	....	5,080	....	5,790	5,200	....

.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
25	6,030	10,525	6,810	6,675	9,250	19,575	14,530
00	6,125	....	6,340	6,400	11,450	16,555	13,525
50	6,275	10,075	6,625	....	....	14,030	12,325
50	....	9,125	....	7,125	17,400	....	10,730
40	8,025	8,580	....	7,225	22,900	12,410	....
25	9,250	8,175	....	7,125	22,600	12.875	9,400
...	8,520	7,625	6,420	6,930	18,250	....	10,760
50	8,250	7,025	6,300	8,075	14,225	14,065	19,950
50	8,025	....	6,830	7,975	12,350	14,150	20,220
00	7,350	6,650	6,460	....	....	13,625	15,790
725	....	6,340	6,870	6,700	24,000	13,855	13,625
300	13,750	6,700	6,830	7,150	22,500	14,300	....
050	14,150	6,810	....	8,900	17,855	14,800	11,225
....	11,740	7,075	8,075	12,040	14,250	....	11,225
075	10,100	7,500	7,000	16,130	12,675	28,900	13,675
275	9,150	....	6,700	15,160	11,650	30,100	14,590
360	8,275	6,460	6,930	....	....	23,900	12,650
320	....	6,225	6,675	13,600	10,210	24,900	11,350
300	7,740	6,575	6,790	12,850	9,425	23,500	....
010	7,700	6,380	....	11,980	9,050	19,505	9,525
....	7,860	6,870	6,950	11,075	9,000	....	9,025
,320	7,500	7,740	6,790	10,600	8,150	14,650	8,690
,225	7,150	....	7,275	9,625	8,000	13,785	8,660
,480	7,250	8,840	7,025	....	....	13,525	7,975
,500	....	....	6,675	9,275	9,025	14,710	7,820
,460	15,460	7,450	6,500	8,350	8,900	14,860	....
,175	11,300	7,075	....	8,420	9,350	13,855	8,500
....	11,650	6,870	6,830	8,420	13,925	....	10,075
,440	....	6,830	7,075	....	18,280	12,410	12,175
,225	10,730	....	6,525	....	18,520	13,750	10,700
,970	....	6,725	6,930	....	....	....	9,150

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1866.							
1	11,125	....	7,200	8,500	....	5,910	4,920
2	9,100	11,325	7,025	7,780	5,525	6,075	....
3	8,400	10,760	6,950	....	5,360	5,550	....
4	....	10,760	6,460	6,910	....	5,425	4,780
5	7,325	....	6,250	5,120	5,140	....	4,920
6	6,975	9,275	....	6,550	5,060	5,360	4,540
7	6,700	10,050	5,930	6,340	4,800	5,100	4,860
8	6,400	....	5,750	6,460	....	5,040	4,840
9	5,970	10,525	5,810	6,700	5,200	4,880	....
10	6,010	9,275	5,850	....	4,900	5,180	4,880
11	....	8,580	6,125	8,150	5,000	5,000	5,040
12	5,890	8,440	6,200	7,300	4,800	....	5,000
13	5,830	8,050	....	6,910	4,700	5,240	4,900
14	6,050	8,560	6,010	6,575	4,840	5,080	6,625
15	6,420	....	6,030	6,460	....	4,960	5,650
16	6,850	9,200	6,010	6,550	4,920	4,960	....
17	10,525	9,225	5,850	....	4,960	5,380	5,220
18	....	8,480	5,850	6,460	4,500	6,175	5,000
19	10,700	8,420	6,125	6,950	4,900	....	5,360
20	8,750	8,325	....	12,225	4,840	5,240	5,100
21	7,860	9,775	5,910	9,775	4,360	5,260	5,830
22	7,475	....	5,850	7,950	....	5,400	6,810
23	6,870	11,375	5,870	7,050	5,040	5,100	....
24	6,870	10,760	6,400	....	5,060	5,240	7,780
25	....	13,785	5,910	6,175	5,000	5,280	6,700
26	6,600	14,225	5,710	6,525	5,100	....	6,050
27	5,690	11,325	....	5,525	5,100	5,400	6,250
28	6,360	9,275	6,830	5,750	5,100	5,300	7,675
29	6,675	....	10,600	5,360	....	5,000	8,400
30	10,760	7,700	11,375	5,750	6,500	5,000	....
31	11,375	....	10,125	....	6,050	4,820	....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1866–67.												
1	6,750	16,860	8,440	6,600	6,250	6,575	7,925	9,850	9,250	5,500	5,000	....
2	6,250	11,125	....	6,300	6,100	6,625	10,300	11,830	....	5,060	5,080	6,890
3	5,990	8,560	9,350	6,525	....	....	11,740	16,800	8,150	5,080	7,700	6,500
4	5,810	....	8,100	6,420	6,125	6,890	....	14,175	8,720	....	....	6,175
5	5,650	6,850	7,650	5,950	6,030	6,790	13,700	....	13,110	5,020	8,840	6,175
6	5,220	6,500	8,200	....	6,300	6,600	14,440	9,975	10,700	5,000	7,700	5,710
7	....	6,225	8,500	6,010	5,950	6,525	....	9,375	8,780	....	6,650	5,790
8	5,300	5,970	7,860	6,910	5,950	6,460	13,890	8,950	8,025	5,360	6,340	....
9	5,160	5,950	....	6,830	6,050	6,360	13,625	10,390	....	5,340	6,050	5,650
10	5,320	5,810	9,350	6,275	....	....	13,925	17,160	7,125	5,200	5,670	5,650
11	5,160	....	9,050	5,970	11,800	6,125	14,650	15,955	7,275	5,100	....	5,475
12	5,080	5,600	7,780	6,150	15,100	6,500	18,640	....	6,910	5,000	5,600	5,550
13	5,040	5,650	6,830	....	14,920	6,625	18,250	11,450	6,550	4,920	5,400	5,400
14	....	5,930	6,250	6,340	....	6,700	....	10,700	6,460	....	5,040	5,340
15	5,180	5,850	6,050	6,250	15,400	6,360	13,700	11,275	6,100	5,020	5,610	....
16	5,160	5,850	....	6,175	16,400	6,300	12,800	12,125	....	4,840	7,075	5,380
17	5,140	12,850	5,575	5,710	....	....	15,920	11,860	6,275	....	16,025	5,400
18	5,180	....	5,710	6,075	13,410	5,750	27,000	10,910	7,350	4,720	....	5,180
19	5,140	12,410	5,525	9,100	11,680	6,250	24,700	....	8,000	4,720	19,575	5,000
20	5,100	9,900	5,750	....	10,850	5,970	17,960	9,300	8,480	4,820	14,860	5,120
21	....	9,150	6,400	7,150	9,650	5,950	....	9,225	8,420	....	11,560	5,120
22	5,140	10,150	6,010	6,950	8,720	6,075	13,600	8,600	7,550	5,950	9,575	....
23	5,100	8,950	....	6,460	8,440	6,100	14,590	8,630	....	5,890	8,720	5,690
24	5,060	7,900	5,890	6,360	....	....	18,370	9,350	6,300	5,670	9,000	5,220
25	5,020	....	....	7,000	7,760	6,100	15,550	9,350	5,990	5,340	....	5,120
26	5,000	7,150	8,720	6,100	7,500	7,450	13,170	....	5,930	5,220	9,025	5,020
27	4,820	6,650	8,560	....	7,450	7,820	11,740	8,750	5,750	5,340	8,000	4,800
28	....	6,500	8,480	6,340	7,075	7,800	....	14,710	5,930	....	7,425	4,800
29	5,060	....	8,540	6,500	....	7,500	10,450	12,150	5,770	5,260	6,850	....
30	5,040	6,460	....	6,460	....	7,075	9,950	10,150	....	5,380	7,350	4,920
31	9,150	....	6,910	6,340	....	....	....	10,025	....	5,080	7,800	....

Merrimack River at Lowell, Mass., for the years –1861; 1866–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	5,890	....	9,050	8,440	14,065	5,670	4,740	5,000
	....	5,770	....	8,440	12,560	5,550	....	4,760
	5,770	5,670	10,700	....	11,300	5,500	4,900	4,860
	6,550	6,075	10,700	8,325	9,900	....	4,860	4,940
	5,910	5,670	....	8,025	9,450	....	4,900	4,860
	5,810	5,910	9,100	7,860	8,630	5,140	5,000	....
	5,790	5,060	8,225	7,900	....	5,020	4,960	8,350
	6,300	....	8,050	8,400	12,470	4,900	4,860	7,025
	....	5,830	7,950	9,275	13,550	4,840	....	6,950
	5,650	6,360	8,250	....	11,250	4,960	5,220	6,500
	6,225	7,575	8,225	8,500	9,900	4,900	5,080	6,810
	5,810	7,900	....	8,075	9,400	....	5,400	9,025
	5,600	8,950	7,950	7,840	9,950	5,320	5,525	....
	5,910	10,850	7,975	9,150	....	4,920	5,240	12,350
	5,400	....	8,100	14,920	9,600	4,840	5,220	10,880
	....	16,275	10,180	16,485	8,560	4,780	....	9,625
	5,910	14,950	15,400	....	8,200	4,700	5,120	7,900
	5,300	17,340	18,030	12,825	8,000	4,920	5,060	7,175
.	5,730	20,150	....	14,275	7,400	....	4,760	6,550
0	5,525	20,900	13,750	16,225	7,075	5,040	4,760	....
5	5,600	17,250	12,470	16,450	....	5,120	5,100	6,300
5	5,575	....	13,750	21,930	7,325	5,000	4,920	6,890
0	....	11,375	13,020	24,500	8,600	4,980	....	7,000
0	6,010	10,050	11,800	....	8,840	4,940	5,140	7,400
0	5,525	9,600	11,175	30,000	8,200	5,000	4,900	8,750
.	5,750	9,075	....	28,300	7,450	....	4,900	13,050
0	5,280	8,950	9,100	22,200	7,050	5,320	4,940	....
0	5,550	8,540	8,975	18,100	....	5,180	5,020	17,925
75	5,600	....	8,540	15,250	6,480	4,940	4,920	15,730
30	....	9,150	8,440	14,100	6,300	5,040	....	12,650
50	....	9,025	....	....	....	5,040	5,040	....
50	6,360	6,725	24,300	13,350	7,860	7,450	....	4,880
90	6,500	6,300	22,950	....	7,740	6,910	5,020	4,600
..	5,650	5,890	21,790	13,700	8,275	6,400	4,920	4,800
30	5,750	5,930	....	14,300	7,800	....	4,940	4,520
75	6,175	6,500	22,700	15,130	7,200	....	4,980	....
50	6,175	6,050	19,990	13,440	....	5,770	4,860	4,820
50	....	....	18,160	12,850	6,870	5,770	4,840	4,720
75	6,010	6,075	....	11,950	6,870	5,500	....	4,780
50	5,600	5,810	18,980	....	6,750	5,360	4,900	4,780
...	5,400	5,525	18,370	11,250	6,460	5,340	4,820	4,840
50	5,600	6,850	....	10,940	6,050	....	4,700	5,360
75	5,425	7,860	16,625	11,000	5,890	6,200	4,620	....
700	5,450	9,150	16,200	10,790	....	5,710	4,540	5,300
275	....	....	15,430	12,175	5,690	5,710	4,800	4,940
175	5,810	9,325	15,160	11,560	5,750	5,400	....	4,960
700	6,850	9,025	15,100	....	5,770	5,550	5,060	4,800
...	7,475	8,420	16,450	12,100	6,100	5,400	5,080	4,800
650	7,450	7,650	....	13,170	5,910	....	5,000	4,460
320	7,125	7,325	22,700	13,020	5,670	5,525	4,960	....
300	6,750	7,125	25,400	11,830	....	5,400	4,920	4,940
,300	....	....	27,400	12,125	5,710	5,340	4,860	4,940
,225	6,360	7,150	31,000	11,590	5,970	5,280	....	4,880
,460	6,400	6,500	33,600	....	6,890	5,160	4,960	4,460
....	6,810	6,380	25,150	9,275	6,675	5,260	4,860	4,720
,690	6,525	6,440	....	8,900	6,500	....	4,740	4,480
,125	6,360	6,340	20,780	8,480	6,460	5,140	4,940	....
,175	5,890	7,075	19,100	8,520	....	5,100	4,760	5,220
,340	....	....	17,100	8,600	6,440	4,960	4,740	5,000
,500	....	13,320	15,400	8,460	6,625	4,760	....	7,250
,340	....	17,130	15,310	....	7,175	5,320	4,640	5,890
....	....	22,950	....	7,900	....	5,060	4,680	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1869–70.												
1	5,525	7,650	7,125	13,785	9,125	9,425	19,990	......	6,225	5,200	4,860	4,820
2	5,200	7,275	9,400	......	8,780	9,100	20,700	13,200	6,125	5,240	4,860	4,580
3	......	7,075	10,575	24,600	8,225	8,950	......	12,300	5,990	......	4,860	4,740
4	5,300	7,075	8,400	34,400	7,800	8,810	19,645	11,650	5,890	......	4,560	......
5	32,600	6,910	......	26,300	8,520	7,900	17,820	11,125	......	5,000	4,800	4,580
6	45,900	6,910	6,850	18,400	......	......	18,250	11,050	5,600	5,000	4,680	4,940
7	25,350	......	5,600	15,400	8,125	7,950	......	10,550	5,750	4,880	......	4,960
8	15,250	6,870	6,810	12,225	7,840	7,675	20,940	......	5,730	5,020	4,840	4,720
9	11,400	6,625	6,675	......	6,750	7,575	21,650	9,200	5,850	4,960	4,580	4,400
10	......	6,500	6,950	9,775	7,100	7,700	......	9,575	6,250	......	4,620	4,600
11	9,525	6,360	7,820	9,450	7,840	7,550	24,600	10,240	6,250	5,360	4,700	......
12	18,400	6,300	......	9,925	7,325	7,175	25,000	10,650	......	5,000	4,620	4,780
13	19,415	6,030	6,750	9,800	......	......	30,300	11,590	5,890	5,000	4,740	4,740
14	17,100	......	6,600	9,325	7,575	6,400	32,350	11,710	5,850	7,050	......	4,420
15	20,255	5,850	6,850	9,750	7,350	6,850	28,000	......	5,850	4,960	4,620	4,600
16	16,696	5,575	6,340	......	7,860	7,475	26,200	9,850	5,730	4,920	4,700	3,940
17	......	5,550	6,320	9,950	8,870	6,850	......	9,350	5,575	......	4,600	4,700
18	14,100	......	6,725	10,675	9,025	6,890	21,140	9,400	5,650	5,000	4,640	......
19	12,175	6,950	......	12,100	16,275	7,025	26,200	8,950	......	4,960	4,540	4,580
20	10,700	6,850	7,900	12,250	......	......	50,400	8,400	5,575	4,960	4,360	4,540
21	9,650	......	7,840	11,125	29,000	7,050	58,400	8,175	5,550	4,860	......	4,400
22	9,175	14,410	7,650	9,900	19,250	7,425	44,000	......	5,475	4,860	4,580	4,480
23	8,275	11,950	7,840	......	14,950	7,900	34,200	7,650	5,360	4,860	4,780	4,240
24	......	9,800	8,925	9,550	12,800	8,325	......	7,450	5,260	......	4,580	4,200
25	11,200	8,810	......	9,900	11,050	8,300	21,790	7,500	5,360	5,060	4,580	......
26	11,250	8,000	......	10,760	9,575	8,000	23,000	7,625	......	7,025	4,680	4,400
27	9,700	7,450	9,775	12,350	......	......	22,000	7,350	5,380	4,920	4,580	4,700
28	9,025	......	12,350	12,225	9,775	9,525	18,940	7,200	5,320	4,660	......	4,400
29	8,300	7,150	14,590	11,200	......	13,050	17,040	......	5,240	4,840	4,820	4,300
30	8,025	6,890	16,800	......	......	15,310	16,890	6,830	5,300	4,740	4,620	4,520
31	......	......	17,190	9,375	......	18,250	......	6,525	......	......	4,740	......
1870–71.												
1	4,300	4,840	5,340	......	4,920	8,950	7,975	8,630	5,600	5,000	4,840	6,175
2	......	4,880	5,260	4,880	4,820	8,175	......	8,150	5,890	......	4,860	6,400
3	4,540	4,800	5,140	4,920	5,020	7,450	7,450	7,950	5,850	5,000	4,840	......
4	4,580	4,660	......	4,880	4,940	7,525	7,450	7,820	......	......	4,900	5,280
5	4,740	5,020	4,960	4,880	......	......	7,675	10,730	5,425	5,000	4,800	4,960
6	4,760	......	5,040	4,840	5,625	8,200	......	20,325	5,360	5,020	......	4,960
7	4,660	5,360	4,900	4,840	4,820	7,840	7,525	......	5,300	4,940	4,860	4,700
8	4,600	5,260	5,000	......	4,720	7,600	7,100	21,545	5,100	4,480	4,800	......
9	......	4,920	5,000	4,980	4,600	7,400	......	18,250	5,200	......	4,720	4,840
10	4,660	4,960	5,400	4,960	4,700	7,050	8,325	14,300	5,060	4,840	4,660	......
11	4,640	4,840	......	4,800	4,700	7,350	8,440	12,225	......	5,060	4,700	4,800
12	4,720	6,225	5,200	4,700	......	......	8,350	10,700	5,180	5,020	4,560	4,660
13	4,660	......	5,300	4,600	5,100	17,160	9,750	9,825	5,180	4,900	......	4,640
14	4,460	5,160	6,625	4,780	4,880	22,900	9,950	......	5,160	4,840	4,860	4,680
15	4,480	5,060	6,950	......	4,880	15,610	8,560	8,580	5,160	4,940	4,840	4,540
16	......	5,140	6,275	4,700	4,700	11,425	......	7,860	5,180	......	4,700	4,600
17	4,640	5,100	5,525	5,340	4,760	9,700	7,425	7,500	5,200	4,820	4,740	......
18	4,600	5,180	......	5,950	4,700	8,925	7,720	7,075	......	4,420	4,300	4,560
19	4,740	5,100	5,200	6,340	......	......	7,900	7,025	5,650	4,360	4,500	4,560
20	4,500	......	5,280	6,100	7,375	7,900	7,500	6,890	6,725	4,680	......	4,660
21	4,640	5,180	5,180	5,500	7,800	8,025	8,250	......	6,950	4,560	4,600	4,640
22	4,500	4,940	5,180	......	7,375	12,800	9,275	6,625	6,440	4,500	4,680	4,760
23	......	4,920	5,340	6,400	6,625	15,400	......	6,850	6,010	......	4,560	4,320
24	5,140	......	5,550	5,750	5,910	12,560	9,400	6,975	5,690	4,740	4,560	......
25	4,940	5,400	......	5,600	6,625	10,910	8,500	6,725	......	4,500	4,600	4,800
26	4,620	5,320	5,450	5,690	......	......	8,025	6,500	5,360	4,600	4,420	4,440
27	4,880	......	5,100	5,575	11,250	8,540	7,425	5,910	5,360	4,420	......	4,600
28	4,640	5,690	4,700	5,320	10,300	8,175	7,250	......	5,200	4,320	4,700	4,600
29	4,840	5,300	4,740	......	......	7,975	8,500	5,890	5,140	4,360	4,700	4,380
30	......	5,280	5,080	5,180	......	7,700	......	5,650	5,040	......	5,750	4,360
31	4,900	......	4,720	4,960	......	7,650	......	5,550	......	4,760	6,150	......

of Merrimack River at Lowell, Mass., for the years 848–1861; 1866–1915—Continued.

	ı.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	400	5,300	5,280	6,100	9,250	7,175	6,100	6,075	....
	340	5,360	5,180	5,710	8,900	....	5,850	5,750	11,275
	175	5,200	....	5,870	10,300	7,125	5,525	5,525	9,325
	030	....	4,940	....	13,500	7,150	....	....	8,075
	340	5,320	5,425	7,300	....	7,250	6,600	5,550	7,500
	,575	5,120	5,525	8,400	10,700	11,500	6,500	5,360	7,2
	....	5,100	5,260	....	9,650	14,065	....	5,240	6,575
	,750	5,220	5,000	11,050	8,925	12,350	5,810	5,100	50
	,400	5,220	4,820	15,100	8,440	....	5,670	5,000	6,200
	,900	4,960	....	17,400	8,720	10,850	5,525	4,920	5,990
	,740	....	5,380	25,500	8,600	11,025	5,400	....	6,050
	,760	4,960	5,730	27,400	....	16,025	5,360	5,400	5,970
	,675	4,880	5,930	23,700	7,575	12,800	5,360	5,320	5,990
	....	5,000	5,525	....	7,350	10,700	....	5,400	6,320
	,320	5,500	5,525	21,930	7,250	9,650	5,400	7,700	....
	5,320	5,400	5,850	17,400	6,910	....	5,160	10,525	8,690
	5,140	5,380	....	14,350	6,500	8,325	5,100	10,300	8,350
	5,425	....	5,120	12,300	6,440	7,650	4,980	....	9,825
	5,040	5,140	5,100	11,375	....	7,125	5,140	15,490	9,350
	5,100	5,100	5,550	11,650	6,500	6,870	5,060	11,050	9,000
	.....	5,040	5,340	....	6,810	6,500	....	8,560	8,900
	5,425	5,100	5,120	12,225	7,450	6,075	5,450	7,700	....
	5,320	5,400	4,900	14,530	7,150	....	5,120	8,630	7,700
	5,360	5,040	....	14,250	7,375	5,790	5,200	12,150	7,175
	5,650	....	5,020	12,250	8,750	5,790	5,475	....	6,790
	5,710	5,300	5,000	11,275	....	5,870	5,200	8,025	6,810
	5,200	5,750	4,880	10,650	7,400	5,990	5,200	7,250	6,850
	......	5,240	5,000	....	7,050	6,750	....	6,675	9,200
	5,020	5,120	5,450	11,425	6,950	6,700	5,450	6,300	....
	5,525	....	5,750	9,900	7,325	....	5,770	6,225	8,810
	5,550	....	....	....	7,650	....	6,250	8,275	....
	7,075	7,050	5,970	12,960	13,140	....	4,840	5,120	5,060
	7,050	....	....	14,650	13,230	6,810	4,800	5,080	5,000
	6,400	7,450	6,100	....	14,350	6,575	4,920	....	5,160
	6,275	6,910	6,100	16.520	....	6,500	....	5,140	4,960
	....	6,790	6,400	17,340	15,250	6,340	5,000	5,140	4,940
	6,790	6,975	6,340	....	14,100	6,175	....	4,960	4,900
	7,075	6,850	6,340	17,250	13,200	6,750	5,425	4,900	....
	7,400	6,850	5,930	17,100	11,980	....	5,100	4,940	5,200
	6,830	....	....	17,750	11,175	6,750	4,960	4,940	5,040
	7,000	8,250	6,050	20,580	11,680	6,500	5,060	....	5,160
	7,200	7,475	6,200	25,700	....	5,990	5,020	5,060	4,980
	....	7,400	6,100	27,550	14,710	6,030	5,000	5,060	5,000
	6,950	6,890	6,300	....	19,575	6,125	....	4,900	4,800
	6,380	6,790	6,300	26,300	18,100	5,950	5,000	5,040	....
	6,400	6,625	6,250	24,300	15,100	....	5,000	5,000	5,040
)	6,400	....	....	21,825	12,650	5,750	4,960	5,040	5,160
)	6,700	6,400	6,340	20,900	11,250	5,600	4,920	....	5,060
)	8,400	6,300	6,440	20,900	....	5,450	4,900	5,000	5,080
)	....	6,125	6,300	20,360	9,950	5,340	5,280	5,000	5,000
0	13,020	6,300	6,675	....	9,175	5,340	....	5,000	5,040
0	11,500	6,380	6,550	19,190	8,900	5,240	6,100	5,080	....
.	11,800	6,275	6,750	19,470	8,520	....	5,710	5,080	6,500
0	9,900	....	....	18,430	9,025	5,140	5,260	5,160	5,500
5	9,150	7,075	6,675	16,890	9,525	5,100	5,100	....	5,320
.	9,150	6,625	6,600	16,200	....	5,000	5,040	5,260	5,425
75	....	6,100	6,300	15,700	10.575	4,900	5,000	5,100	6,830
25	8,075	6,300	6,380	....	9,975	4,900	....	5,200	5,930
20	7,700	6,300	6,250	13,625	8,925	4,800	5,040	7,175	....
..	7,720	....	6,225	13,785	9,300	....	5,040	4,940	5,300
00	7,720	....	....	13,890	9,075	5,020	4,960	5,000	5,200
75	7,525	....	10,450	....	8,250	....	5,040	....	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—**Continued.**

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1873–74.												
1	5,120	7,975	6,870	5,890	....	....	6,950	12,470	9,650	7,450	6,525	5,160
2	5,040	....	6,050	6,175	7,700	7,250	....	11,920	10,350	6,790	....	5,160
3	5,160	7,450	5,770	6,125	7,375	7,475	6,625	....	10,150	6,500	6,050	5,060
4	4,960	7,000	5,850	....	6,675	9,275	6,790	11,920	9,225	....	5,670	5,200
5	....	6,550	9,900	8,225	7,075	12,275	....	12,900	8,480	....	5,710	5,060
6	5,120	6,300	12,900	13,925	7,225	14,410	6,400	13,200	8,600	12,380	5,450	....
7	5,500	6,460	....	14,950	6,950	13,380	6,400	13,600	....	11,680	5,400	5,040
8	14,065	6,300	10,330	16,375	....	....	6,790	12,500	9,200	9,550	5,360	5,000
9	15,700	....	8,840	28,750	7,300	9,750	6,910	14,440	9,425	8,400	....	5,000
10	10,880	8,500	8,580	30,800	6,500	8,150	7,700	....	9,200	7,525	6,500	4,960
11	8,660	7,780	8,560	....	7,720	7,300	7,925	13,200	8,200	7,450	6,360	4,640
12	....	7,325	7,740	16,060	6,930	6,625	....	14,950	7,820	....	5,890	4,740
13	6,790	7,025	8,150	12,150	6,500	7,475	7,760	13,350	7,700	15,700	5,670	....
14	6,175	6,930	....	10,575	6,770	6,750	7,600	12,040	....	17,925	5,830	4,520
15	5,950	6,810	9,500	9,100	....	....	7,900	12,675	7,860	15,400	7,250	5,140
16	5,810	....	8,900	7,550	12,250	6,950	9,650	12,350	7,300	12,590	....	4,960
17	5,650	6,340	7,975	8,400	11,150	6,790	11,125	....	7,000	10,625	6,300	4,900
18	5,650	6,100	7,880	....	10,550	7,125	10,475	14,500	8,300	9,125	5,850	5,020
19	....	6,225	7,475	8,050	8,075	8,200	....	12,725	17,280	....	5,750	5,100
20	5,525	6,075	7,475	8,225	7,525	10,760	9,225	12,350	16,130	7,500	5,575	....
21	8,400	6,250	....	8,900	7,325	12,650	10,450	11,530	....	6,975	5,425	5,525
22	26,100	6,050	6,650	8,500	....	....	11,950	14,100	9,975	7,760	5,550	5,360
23	19,830	....	6,340	8,900	9,875	10,150	11,300	20,325	8,750	7,350	....	5,140
24	13,080	5,870	5,990	10,650	11,800	9,150	10,850	....	8,225	6,870	5,870	5,140
25	9,975	5,970	....	....	10,650	7,900	10,790	13,925	8,150	6,400	5,600	5,040
26	....	6,750	6,300	11,200	9,100	7,625	....	13,960	8,225	....	5,500	5,060
27	7,860	....	5,950	10,100	8,325	7,740	10,500	17,400	7,375	5,750	5,320	....
28	8,150	6,340	....	8,580	8,540	7,840	11,350	14,950	....	5,650	5,280	4,900
29	13,550	6,300	5,930	8,400	....	....	12,410	12,675	6,320	5,600	5,220	4,980
30	10,910	....	6,200	8,025	....	7,375	13,320	11,475	6,320	6,030	....	5,000
31	9,275	....	6,700	7,575	....	7,175	....	....	....	6,700	5,360	....
1874–75.												
1	5,000	....	5,425	5,000	5,240	9,525	7,475	10,300	6,100	5,400	....	5,280
2	5,380	5,120	5,770	4,740	5,360	9,000	8,840	....	5,970	5,340	5,160	5,040
3	5,600	5,040	5,400	....	5,240	7,700	12,010	12,225	5,890	5,160	5,040	4,950
4	....	4,940	5,525	4,960	5,100	7,325	....	12,650	5,790	....	5,200	5,080
5	5,550	5,120	5,340	4,840	5,400	6,870	25,150	11,125	5,525	....	5,020	....
6	5,400	4,900	....	4,900	5,200	6,675	31,700	9,600	....	5,300	5,690	5,360
7	5,240	4,960	5,450	4,840	....	....	29,300	9,650	5,525	5,340	5,575	5,000
8	5,220	....	5,220	4,640	5,710	6,175	....	13,380	5,400	5,100	....	5,260
9	5,160	5,040	5,200	4,760	5,670	5,770	19,470	....	5,450	5,450	5,500	5,200
10	5,475	5,200	5,160	....	5,730	5,575	15,920	13,650	5,930	5,600	6,650	5,000
11	....	5,140	5,220	5,550	5,525	5,525	....	13,750	6,500	....	5,340	5,260
12	6,010	5,000	5,080	5,360	5,750	5,475	17,310	12,900	6,750	5,300	5,040	....
13	5,670	4,920	....	5,080	6,125	5,550	16,695	12,150	....	5,060	5,080	5,200
14	5,475	4,940	5,160	4,940	....	....	14,500	12,300	6,225	5,200	5,280	5,040
15	5,380	....	5,710	5,380	6,460	5,650	12,620	10,730	5,910	5,060	....	5,180
16	5,360	5,240	5,180	5,475	6,460	6,100	13,625	....	5,690	5,120	5,180	5,140
17	5,200	5,000	5,160	....	5,770	7,100	16,400	9,275	....	5,100	5,120	5,160
18	....	4,940	5,160	5,810	5,790	8,175	....	8,500	4,900	....	5,120	5,240
19	5,320	4,880	4,860	5,575	5,750	8,350	19,950	8,250	5,790	5,240	5,380	....
20	5,280	5,140	....	5,475	5,625	7,760	15,250	7,800	....	5,160	7,125	5,220
21	4,960	4,860	5,060	5,320	....	....	12,530	7,860	12,275	5,060	6,930	5,280
22	5,000	....	5,120	5,380	5,600	7,000	10,760	8,150	12,100	5,000	....	5,260
23	5,180	5,220	4,960	5,340	5,360	6,750	9,975	....	7,900	5,020	6,340	5,220
24	5,120	5,200	4,900	....	5,400	6,575	9,850	8,900	6,625	5,100	5,810	5,280
25	....	5,160	....	5,425	5,750	6,050	....	8,250	6,460	....	5,525	5,160
26	5,220	....	4,560	5,400	7,740	5,770	11,200	8,175	6,175	5,240	5,400	....
27	5,140	5,240	....	6,250	8,350	5,575	11,475	8,350	....	5,100	5,360	5,260
28	5,240	5,200	5,160	5,380	....	....	11,000	7,700	5,990	5,040	5,280	5,000
29	5,080	....	5,100	5,240	....	6,050	10,360	6,890	5,870	....	....	5,000
30	5,000	5,750	5,500	5,220	....	6,150	10,300	....	7,200	4,940	5,200	5,160
31	5,000	....	5,600	....	....	6,675	....	6,500	....	4,920	5,320	....

, of Merrimack River at Lowell, Mass., for the years 1848–1861; 1866–1915—Continued.

		an.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
		6,200	5,910	5,670	21,825	13,260	7,780	5,600	5,525	4,880
		....	6,050	5,525	....	13,380	7,475	....	5,910	4,740
		8,900	7,325	5,710	14,650	12,250	6,890	5,340	5,770	....
		10,075	6,175	5,650	13,995	11,680	....	....	5,710	4,860
		9,050	6,300	....	12,775	11,500	8,025	5,450	5,450	4,860
		7,250	....	5,500	12,800	11,075	11,300	5,340	....	4,940
		7,250	5,650	6,250	13,440	....	10,500	5,300	5,575	4,900
		6,625	6,050	12,900	14,680	12,470	9,075	5,140	5,120	4,900
		....	6,750	19,280	....	15,100	7,975	....	5,200	4,560
		6,550	6,750	18,610	14,440	17,715	7,525	5,425	5,220	....
		6,910	6,360	15,790	14,350	18,130	....	5,200	5,340	5,000
		7,025	6,340	....	14,410	22,700	7,575	4,960	5,100	4,900
		7,175	....	10,600	....	23,200	6,950	5,200	....	4,860
		6,380	8,025	10,150	19,220	....	6,975	5,300	5,450	4,860
		5,650	7,400	10,050	23,200	14,150	6,910	5,240	5,400	4,920
	5	....	7,500	9,000	....	12,850	6,725	....	5,200	4,400
	0	5,650	7,700	8,225	29,000	11,530	6,675	5,320	5,040	....
	0	5,650	7,575	7,860	23,800	11,125	....	5,340	4,960	5,040
	.	5,750	7,350	....	19,950	10,910	6,150	4,900	5,160	4,900
	75	6,380	....	7,050	16,375	10,650	5,990	5,000	....	4,960
	50	7,250	6,930	7,050	15,010	....	5,950	5,060	5,280	5,000
	00	7,740	6,625	15,100	14,950	10,390	5,970	5,040	5,060	5,380
	00	....	6,300	16,325	....	11,620	5,910	....	4,980	5,200
	90	6,480	7,025	15,250	15,280	12,275	5,890	5,220	4,900	....
	..	6,100	7,050	13,260	16,325	10,500	....	5,300	4,840	5,280
	...	5,930	6,300	....	15,640	9,525	5,650	5,575	4,740	5,140
	250	5,910	....	28,650	14,470	9,175	5,500	5,475	....	5,080
	550	5,575	5,690	27,100	13,625	....	5,710	5,160	4,960	5,120
	550	5,710	5,625	25,150	13,550	8,400	5,990	5,120	4,880	5,000
	525	....	....	31,750	....	8,720	5,730	....	4,980	5,200
	300	6,225	....	28,000	....	8,480	....	6,175	4,820	....
	,650	5,280	5,200	5,200	....	9,425	5,790	....	8,100	6,050
	,525	5,475	5,475	5,120	16,730	9,600	5,690	7,075	6,790	....
	....	5,670	5,320	5,525	15,640	11,325	....	7,425	6,050	5,890
	,425	5,690	....	....	15,160	10,700	5,600	....	5,625	5,690
	,380	5,690	5,300	7,200	14,300	9,600	5,525	6,460	....	5,475
	5,280	5,670	5,300	7,200	14,350	....	5,400	5,810	5,550	5,180
	5,340	....	5,340	7,625	15,340	8,150	5,550	5,690	5,500	5,360
	5,100	5,300	5,200	7,325	....	7,900	5,750	....	5,450	5,360
	5,060	5,475	5,080	7,625	13,230	7,700	6,380	5,600	5,320	....
	....	5,500	5,400	11,890	12,440	7,450	....	5,475	5,000	5,400
	5,500	5,525	....	....	11,890	7,780	6,225	5,550	5,360	5,320
	5,180	5,400	5,120	16,425	....	7,700	6,010	5,550	....	5,140
	4,920	5,525	5,670	13,925	11,425	....	6,175	5,575	5,260	5,100
	4,960	....	5,670	11,650	10,650	7,275	5,970	5,400	5,380	5,220
	4,840	5,790	5,300	10,390	....	6,910	5,750	....	5,340	5,080
	4,940	5,730	5,100	9,375	9,600	7,100	5,650	5,450	5,400	....
	....	5,790	5,160	8,520	9,375	7,200	....	5,300	5,950	5,140
	5,280	5,690	....	....	9,225	7,075	5,600	5,140	6,790	5,260
	5,360	5,450	5,220	7,450	9,650	7,100	5,550	5,300	....	5,320
	5,200	5,380	5,525	7,325	11,800	....	5,100	5,450	5,850	5,280
	5,200	....	5,160	7,100	15,430	6,275	5,450	5,500	5,690	5,000
	5,120	5,320	4,980	7,300	....	6,675	5,450	....	5,525	5,000
5	5,140	5,340	5,160	8,175	14,710	6,600	5,380	6,100	5,380	....
0	....	5,625	5,100	9,400	12,530	6,250	....	5,600	5,340	5,120
5	....	5,850	....	....	11,770	6,910	5,575	5,400	5,320	4,980
..	5,320	5,690	5,320	9,975	11,620	7,550	5,360	5,400	....	5,020
90	5,280	5,425	5,280	13,500	11,000	....	5,260	5,400	10,550	4,880
50	5,180	....	5,200	29,100	9,775	7,050	5,400	5,260	11,500	4,900
25	5,040	5,400	....	41,500	....	6,850	5,380	....	7,860	4,780
..	5,240	5,280	....	38,000	9,225	6,500	5,020	5,500	6,870	....
..	....	5,380	....	26,500	....	6,050	....	5,500	6,300	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the year ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1877–78.												
1	4,700	6,820	11,950	6,100	6,460	8,600	12,275	32,700	5,830	6,125	5,380	......
2	4,700	6,500	......	5,650	6,725	8,580	11,450	28,550	......	5,690	5,340	5,47
3	4,600	7,720	9,525	5,650	......	......	11,225	22,350	5,690	5,525	5,550	5,40
4	4,600	......	8,630	5,550	7,000	10,790	10,760	17,310	5,575	......	......	5,36
5	4,960	11,125	8,540	5,600	6,380	11,425	10,730	......	5,450	......	5,850	5,45
6	6,650	10,300	9,200	......	6,360	11,450	11,275	14,300	5,500	......	5,340	5,600
7	......	12,675	13,500	6,100	6,300	11,050	......	16,765	5,320	......	5,380	5,575
8	6,300	11,890	13,410	5,750	6,360	10,730	11,250	14,250	5,400	5,550	5,810	......
9	5,850	10,760	......	5,650	6,460	13,785	10,575	12,150	......	5,500	6,700	5,575
10	6,010	16,325	9,850	5,475	......	......	10,075	11,225	7,740	5,080	8,600	5,450
11	6,650	......	9,500	5,970	8,750	16,165	......	10,420	8,300	5,300	......	5,340
12	7,720	12,750	8,400	7,820	8,630	16,920	10,450	......	7,650	5,340	9,100	5,450
13	8,600	11,225	8,300	......	7,780	14,980	18,980	9,200	7,250	5,140	7,650	5,360
14	......	9,775	8,200	8,720	7,625	14,470	......	8,660	7,000	......	6,790	5,400
15	7,675	9,125	7,150	9,175	7,625	14,150	16,555	8,200	6,575	5,340	6,125	......
16	7,025	8,540	......	9,250	6,910	13,600	13,750	8,100	......	5,300	5,850	5,730
17	6,770	8,225	7,840	8,660	......	......	12,100	7,740	5,950	5,380	5,830	5,575
18	6,870	......	7,840	7,600	6,675	12,960	11,350	7,525	5,990	5,240	......	5,400
19	6,790	8,300	7,400	7,150	7,000	14,275	11,050	......	6,010	5,120	5,910	5,320
20	6,625	8,480	7,075	......	6,320	14,100	10,300	7,500	5,890	5,000	5,950	5,280
21	......	7,800	7,025	7,100	6,030	13,080	......	6,975	5,770	......	5,810	5,200
22	7,700	7,500	6,950	7,840	6,275	11,980	9,725	6,950	5,525	5,280	5,600	......
23	8,300	7,150	......	9,250	7,050	5,930	10,240	6,910	......	5,280	5,425	5,320
24	8,900	7,075	6,675	9,475	......	......	10,025	6,975	8,100	5,140	5,550	5,300
25	8,375	......	......	7,760	10,210	11,100	9,575	6,575	10,300	5,400	......	4,920
26	7,700	8,690	6,625	7,700	9,775	11,050	9,775	......	9,400	5,280	5,650	4,800
27	7,840	14,100	6,100	......	9,075	10,525	16,890	6,500	7,860	5,160	5,690	4,900
28	......	17,855	6,050	8,420	8,810	10,150	......	6,275	7,075	......	5,750	4,800
29	6,420	......	6,050	8,540	......	10,150	23,900	6,225	6,500	5,300	5,575	......
30	6,850	12,750	......	8,250	......	11,375	30,100	5,970	......	5,425	5,525	4,760
31	6,550	......	6,050	7,225	......	......	......	5,830	......	5,320	5,550	......
1878–79.												
1	4,860	5,710	......	6,550	5,810	7,700	10,790	24,600	......	6,700	5,500	5,260
2	4,780	5,790	9,975	6,100	......	......	10,025	24,200	5,950	6,420	5,360	5,140
3	4,520	......	12,300	6,300	6,300	7,425	......	19,810	5,810	5,930	......	5,060
4	4,700	5,550	23,200	6,830	5,400	7,025	9,700	......	6,360	......	5,240	5,320
5	4,920	5,400	20,150	......	5,500	7,050	9,100	13,995	8,480	5,360	5,240	5,060
6	......	5,380	15,580	7,200	5,500	7,525	......	12,875	9,325	......	5,000	5,320
7	4,800	5,320	12,175	6,810	5,575	7,175	8,075	12,850	8,925	5,550	5,000	......
8	4,640	5,200	......	6,200	5,650	6,950	9,275	12,850	......	5,500	5,020	5,260
9	4,700	5,200	9,300	6,075	......	......	10,300	11,075	7,500	5,380	4,880	5,260
10	4,600	......	8,600	6,200	6,100	6,600	11,350	10,420	6,950	5,000	......	5,180
11	4,740	5,240	23,000	6,480	5,575	6,830	12,300	......	6,460	5,360	5,160	5,320
12	4,740	5,240	49,600	......	7,125	8,050	11,860	9,425	6,100	5,120	5,100	5,200
13	......	5,060	36,000	6,275	10,450	9,200	......	9,350	6,930	......	5,040	5,180
14	4,940	5,080	23,300	5,770	13,110	9,100	11,000	9,325	7,075	5,000	4,920	......
15	4,980	5,120	......	5,950	14,500	8,630	11,920	9,725	......	5,320	4,940	5,240
16	4,900	4,900	13,960	6,400	......	......	13,575	9,400	7,000	5,120	4,880	7,400
17	4,920	......	11,375	6,440	9,450	8,440	15,340	9,925	9,150	5,280	......	7,150
18	4,800	5,380	10,025	5,850	8,480	7,800	15,955	......	10,940	5,280	5,140	5,990
19	4,800	6,525	10,025	......	7,820	7,300	16,830	11,400	7,175	5,220	5,690	5,450
20	......	9,150	8,780	6,200	7,425	7,200	......	11,860	8,275	......	10,850	5,360
21	4,840	8,580	7,900	6,320	7,250	7,175	15,790	12,800	7,450	5,320	10,390	......
22	4,880	5,810	......	5,850	7,550	7,125	16,555	11,590	......	5,320	7,975	5,320
23	4,640	9,975	9,725	5,850	......	......	18,490	10,450	6,750	5,120	6,750	5,100
24	5,320	......	9,500	5,930	6,930	7,275	20,325	8,975	6,050	5,140	......	4,840
25	6,950	14,440	......	5,575	6,850	7,475	21,965	......	5,730	4,960	6,030	5,000
26	8,100	11,450	9,075	......	6,225	8,200	20,395	7,675	5,830	5,600	5,380	5,040
27	......	9,950	8,660	7,375	6,420	9,100	......	7,200	5,790	......	5,400	5,020
28	6,400	......	8,300	5,730	7,625	8,840	17,680	6,850	5,650	6,810	5,525	......
29	5,500	12,990	......	5,810	......	8,975	18,340	6,810	......	7,400	5,340	5,100
30	5,710	12,990	7,450	5,850	......	......	21,650	6,300	6,175	6,380	5,300	4,920
31	5,710	......	7,840	5,790	......	11,800	......	6,075	......	5,690	......	......

f Merrimack River at Lowell, Mass., for the years 48–1861; 1866–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
70	....	11,740	6,675	8,400	5,080	4,780	....	4,660
40	13,020	13,020	6,750	....	5,550	4,820	5,060	4,560
30	10,300	11,800	7,075	8,950	5,830	4,840	4,900	4,480
..	8,600	10,790	....	8,100	5,425	....	4,980	4,560
90	8,560	10,760	13,350	7,700	5,220	....	4,860	....
50	8,150	12,650	18,190	8,000	....	5,650	4,980	4,700
90	8,050	....	17,190	7,760	5,200	5,100	5,000	4,420
75	....	12,410	....	7,550	5,100	5,020	....	4,480
70	7,525	10,575	10,475	....	5,200	4,880	5,020	4,400
30	6,770	9,250	9,575	6,550	5,320	4,840	4,900	4,320
..	6,625	8,580	....	6,360	5,240	....	4,900	4,400
00	6,075	8,250	8,150	6,320	5,160	4,880	4,660	....
10	6,650	7,675	7,950	6,300	....	4,920	4,900	4,440
40	9,700	....	7,600	5,870	5,240	4,700	4,740	4,320
70	....	7,600	7,475	5,930	5,000	5,040	....	4,320
00	13,675	7,250	7,225	....	5,160	4,980	4,960	4,200
70	11,980	7,350	7,450	5,690	5,000	4,980	4,660	4,240
...	10,700	7,150	....	5,320	5,140	....	4,560	4,560
50	11,650	7,075	9,725	5,525	4,700	5,060	4,660	....
75	13,350	7,000	8,925	5,380	....	4,980	4,700	5,040
50	11,500	....	8,870	5,625	5,020	4,940	4,640	4,920
275	....	7,400	8,975	5,380	4,980	5,060	....	4,860
125	9,400	7,450	8,540	....	4,900	5,475	4,660	4,400
100	8,540	7,700	8,175	5,400	4,520	5,475	4,700	4,460
...	7,860	7,475	....	5,340	4,900	....	4,660	4,560
880	7,800	6,870	7,450	5,300	4,820	5,240	4,560	....
475	7,720	6,625	7,275	5,080	....	5,160	4,560	4,660
900	8,150	....	7,325	5,060	4,900	5,080	4,580	4,260
925	....	6,625	7,375	5,060	4,840	5,040	....	4,400
380	....	6,460	7,400	....	4,900	5,080	4,660	4,400
725	....	6,340	....	5,220	....	4,800	4,740	....
360	5,240	6,420	8,150	....	6,950	5,970	5,930	4,500
....	5,500	9,150	8,350	10,270	6,575	5,690	5,320	4,460
680	5,600	10,575	....	9,300	5,930	....	5,240	4,680
,500	5,550	12,070	8,690	8,720	5,910	....	5,280	....
,440	5,320	11,250	8,275	8,420	....	5,220	5,220	5,200
,480	....	....	7,840	8,150	5,990	5,040	5,040	4,940
,080	5,100	9,975	....	8,025	5,550	5,100	....	4,980
,280	4,800	9,200	7,575	....	5,525	5,060	5,160	4,980
....	4,780	9,350	7,700	8,175	5,750	5,000	5,140	5,000
,620	4,640	10,360	....	8,325	5,710	....	5,260	4,840
,360	4,680	14,530	9,475	8,500	6,175	4,900	5,060	....
,440	4,800	16,800	10,790	10,575	....	5,040	4,980	5,080
,440	....	....	11,425	12,200	7,700	5,160	4,900	4,920
,420	8,870	14,650	11,075	10,700	7,075	4,920	....	4,940
,980	9,275	12,930	11,075	....	6,950	4,980	4,960	4,980
....	7,820	12,560	12,040	8,375	6,650	4,700	5,000	4,820
,800	7,900	12,700	....	12,010	5,950	....	4,940	4,980
,040	7,400	12,010	11,950	17,820	5,790	5,020	4,940	....
,640	7,325	11,025	12,300	16,225	....	4,940	4,940	5,060
,720	....	....	12,150	16,025	5,525	4,900	4,640	5,060
,840	6,600	11,375	11,950	14,980	5,400	4,860	....	4,980
,720	3,935	12,100	11,920	....	5,300	4,960	4,620	4,740
....	5,850	12,225	12,650	11,770	5,240	5,000	4,600	4,440
,580	6,650	11,650	....	10,650	5,380	....	4,560	4,940
,040	5,930	10,650	13,050	9,550	5,200	4,940	4,600	....
,740	5,970	9,550	15,040	8,560	....	4,940	4,640	....
,800	....	....	14,560	8,075	5,200	7,350	4,600	4,980
,320	5,625	9,050	13,320	7,700	5,200	7,880	....	4,920
,600	....	8,440	12,850	....	5,425	7,025	4,660	4,800
....	....	8,125	12,825	7,075	5,625	6,725	4,600	4,600
,750	....	8,300	....	6,810	....	....	4,560	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1881–82.												
1	4,840	5,380	5,360	......	7,200	7,500	10,100	7,375	12,900	5,100	4,900	4,240
2	......	5,710	6,725	12,300	7,025	9,450	......	7,325	11,300	......	4,800	4,240
3	5,000	5,360	8,600	8,600	6,675	16,025	8,975	7,150	12,960	5,730	4,900	......
4	4,680	5,320	......	6,550	7,275	21,930	9,475	6,950	......	......	4,820	4,300
5	4,860	5,600	7,300	6,890	......	......	9,725	6,675	11,025	6,225	4,840	4,160
6	4,660	......	6,650	7,125	6,770	16,800	......	6,700	14,980	5,475	......	4,160
7	4,700	6,300	6,500	6,850	6,225	15,700	10,880	......	13,050	5,260	4,920	4,160
8	4,440	6,010	6,675	......	5,790	14,275	10,360	6,500	11,150	5,240	4,900	4,100
9	......	6,300	6,850	6,950	6,360	12,960	......	6,010	9,800	......	4,800	4,100
10	4,580	7,575	6,550	7,840	5,970	12,275	10,390	6,550	9,075	5,220	4,860	......
11	4,560	7,625	......	8,100	6,200	13,550	10,150	7,075	......	5,180	4,760	4,100
12	4,540	7,075	5,400	7,740	......	......	9,650	7,575	8,150	5,080	4,800	4,240
13	4,440	......	5,200	7,275	6,175	12,700	8,810	7,700	7,500	4,960	......	4,400
14	4,600	6,575	5,500	6,830	6,275	11,650	8,420	......	6,810	5,000	4,940	4,440
15	4,600	6,870	6,010	......	7,860	10,420	8,000	8,540	6,700	5,040	4,840	4,400
16	......	6,440	6,460	6,625	9,050	9,425	......	9,750	6,650	......	4,780	4,420
17	4,660	6,050	5,930	6,550	10,300	9,475	7,840	10,550	6,100	5,220	4,840	......
18	4,700	5,970	......	6,420	12,250	9,100	7,760	9,150	......	5,100	4,880	4,480
19	4,640	5,650	5,910	5,950	......	......	7,975	8,600	6,340	5,080	4,600	4,480
20	5,140	......	5,850	6,125	12,410	8,950	8,275	8,000	7,375	4,800	......	4,480
21	5,400	7,950	5,810	5,950	10,850	9,100	9,650	......	9,300	4,900	4,440	4,440
22	5,240	7,700	5,770	......	9,575	9,325	9,950	10,075	8,750	4,860	4,520	4,400
23	......	6,950	5,690	7,325	8,630	9,175	......	10,150	7,425	......	4,480	4,440
24	4,840	......	8,810	7,450	8,690	8,810	8,460	10,820	6,830	4,880	4,520	......
25	4,940	5,890	......	6,125	8,375	8,540	7,900	12,225	......	4,800	4,520	12,380
26	4,820	5,450	8,975	5,425	......	......	7,200	10,450	5,890	4,860	4,480	11,980
27	4,680	......	8,325	5,810	5,360	7,325	7,025	9,450	5,100	4,800	......	9,000
28	4,600	5,710	11,500	7,075	7,475	8,250	6,910	......	5,600	4,880	4,440	7,700
29	4,520	5,080	15,400	......	......	11,025	7,450	9,200	5,400	4,840	4,480	6,460
30	......	5,120	15,100	8,900	......	11,375	......	16,950	5,300	......	4,360	5,990
31	4,720	......	18,610	7,950	......	10,625	......	16,130	......	4,780	4,320	......
1882–83.												
1	......	4,940	4,420	4,300	4,340	5,400	......	7,625	7,025	......	4,780	4,080
2	5,380	4,900	4,340	4,300	4,340	4,960	6,575	7,225	6,930	4,940	4,620	......
3	5,140	4,900	......	4,400	4,340	5,260	6,500	7,050	......	4,960	4,740	4,080
4	4,920	4,920	4,460	4,340	......	......	6,790	7,075	6,480	......	4,680	4,040
5	4,820	......	4,340	4,320	4,160	6,125	......	7,500	5,670	5,020	......	4,000
6	4,860	5,000	4,320	4,260	4,420	5,710	7,275	......	5,525	4,860	4,900	3,940
7	4,760	4,860	4,340	......	4,300	5,600	9,350	8,300	5,750	5,100	4,760	4,960
8	......	4,280	4,400	4,260	4,300	6,400	......	10,150	5,750	......	4,760	3,750
9	5,000	4,240	4,340	4,260	4,340	5,360	9,900	9,025	5,910	4,960	4,760	......
10	5,000	4,240	......	4,380	4,340	5,000	10,940	8,950	......	4,880	4,700	3,895
11	4,880	4,240	4,320	4,300	......	......	13,320	7,900	5,650	4,820	4,760	3,810
12	4,780	......	4,160	4,340	4,500	5,320	14,950	7,675	5,340	4,860	......	3,690
13	4,880	4,320	4,160	4,380	4,540	4,940	16,800	......	6,500	4,880	4,840	3,605
14	4,760	4,240	4,160	......	6,750	5,240	23,100	7,555	6,250	4,940	4,640	3,590
15	......	4,240	4,160	4,420	4,500	5,200	......	6,950	5,870	......	4,580	3,560
16	5,100	4,240	4,160	4,120	4,540	5,200	19,910	7,150	5,670	5,120	4,380	......
17	5,000	4,240	......	4,040	4,420	5,220	17,960	7,225	......	5,670	4,240	3,515
18	4,980	4,280	4,500	4,120	......	......	18,160	7,000	5,340	6,625	4,040	3,690
19	4,860	......	4,420	4,140	4,840	5,670	18,160	6,725	5,120	5,500	......	3,400
20	5,060	4,400	4,340	4,080	5,160	5,970	15,010	......	5,060	5,340	4,160	3,285
21	5,040	4,420	4,340	......	5,360	6,275	15,340	6,575	5,550	5,060	4,240	3,320
22	......	4,420	4,340	4,540	5,240	5,890	......	6,525	13,380	......	4,200	3,300
23	5,240	4,300	4,260	4,680	5,340	6,200	12,530	8,400	8,560	5,040	4,160	......
24	5,040	4,320	......	4,620	5,400	5,525	11,075	12,350	......	4,880	4,200	3,460
25	4,940	4,340	......	4,260	......	......	10,125	12,500	6,250	4,620	3,910	3,440
26	5,040	......	4,420	4,420	5,200	5,710	9,225	10,700	5,360	4,820	......	3,300
27	5,100	4,420	4,380	4,420	5,360	5,710	9,025	......	5,020	4,740	4,160	3,420
28	5,000	4,560	4,420	......	4,920	6,175	8,660	8,100	5,080	4,760	4,180	3,340
29	......	4,420	4,420	4,340	......	6,810	......	7,700	5,000	......	4,260	3,270
30	4,900	......	4,340	4,320	......	6,850	7,720	7,300	4,920	4,820	4,200	......
31	4,900	......	......	4,300	......	6,575	......	6,975	......	4,720	4,120	......

Merrimack River at Lowell, Mass., for the years -1861; 1866–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	5,220	7,550	17,190	9,725	....	4,920	4,820	4,040
	5,140	....	16,200	10,075	6,440	4,800	4,760	3,770
	....	6,950	....	....	6,500	4,800	....	3,880
	5,525	7,125	13,700	....	6,360	....	4,800	3,590
	5,040	6,850	14,410	9,400	6,030	....	4,760	3,400
	5,040	6,010	....	9,450	5,950	....	4,640	3,380
	5,790	5,830	12,650	9,100	....	4,700	4,560	....
	6,030	5,870	12,650	8,750	....	4,800	4,500	3,360
	6,525	....	13,320	8,690	5,750	4,840	4,640	3,320
	....	6,125	13,820	....	5,020	4,860	....	3,575
	6,360	5,425	15,250	....	5,080	4,600	4,840	3,690
	6,200	5,575	16,225	8,900	5,500	4,800	4,700	4,840
	5,710	6,440	....	8,540	5,600	....	4,700	4,460
	5,970	8,400	16,200	7,975	....	4,500	4,740	....
	7,225	9,475	15,955	8,780	....	4,600	4,680	4,880
	8,225	....	17,010	9,375	5,320	4,760	4,660	4,660
	....	9,275	23,700	....	4,800	4,740	....	4,660
	8,720	8,560	26,000	....	4,780	4,700	4,780	4,260
	10,700	8,350	30,800	8,520	4,900	4,660	4,660	4,340
	11,560	8,150	....	8,050	4,860	....	4,660	4,160
	12,200	8,810	22,200	8,500	....	4,840	4,640	....
	11,980	9,025	20,430	12,150	....	4,660	4,620	4,340
	11,650	....	17,820	10,790	4,920	4,340	6,810	4,260
	....	12,225	15,250	....	4,660	4,760	....	4,260
0	11,300	15,040	14,150	....	4,800	4,600	4,880	4,260
0	9,700	17,925	13,995	10,100	4,740	4,700	4,740	4,160
..	9,025	25,200	....	8,870	4,920	....	4,660	4,180
0	8,400	31,000	14,030	8,150	....	4,700	4,660	....
0	8,100	33,800	13,440	8,480	....	4,800	4,600	4,160
0	....	....	12,100	8,950	4,900	4,760	4,660	4,220
0	....	21,475	....	....	....	4,420	....	....
00	....	....	6,790	12,325	5,500	5,160	4,760	4,960
75	5,710	4,980	....	11,125	5,790	4,980	....	5,160
25	5,625	5,260	9,400	....	6,050	4,980	4,760	5,260
..	5,340	5,380	13,020	9,875	5,800	....	5,180	5,000
20	4,960	5,340	....	9,075	5,870	....	6,725	4,760
10	5,000	5,340	14,830	8,460	6,950	4,760	10,525	....
00	5,970	5,320	13,700	7,800	....	4,740	7,600	5,000
75	....	....	13,470	7,860	8,175	5,320	....	4,800
25	4,860	5,710	14,100	7,860	7,450	4,840	....	4,760
00	5,000	5,380	14,175	....	6,625	5,340	5,360	4,840
..	6,910	5,710	13,260	8,780	6,225	5,000	4,640	5,100
50	6,550	5,140	....	8,300	5,690	....	4,640	5,870
40	6,700	5,040	11,300	7,600	5,140	4,780	4,640	....
40	6,600	4,980	10,650	7,100	....	4,600	4,840	5,060
00	....	....	11,000	7,325	5,280	4,620	14,350	4,840
975	6,275	5,140	11,620	7,300	4,860	4,760	....	4,580
725	6,300	5,020	11,325	....	4,660	4,540	7,200	4,600
...	5,870	5,000	11,075	7,300	4,660	4,520	6,075	4,600
730	5,850	5,980	....	7,075	4,660	....	5,140	4,640
830	5,550	5,000	11,125	6,930	4,700	4,680	4,880	....
320	5,450	4,960	11,830	6,930	....	4,660	4,700	4,680
300	....	....	13,020	6,650	4,600	4,700	4,800	4,620
480	4,980	4,820	14,680	6,675	4,660	4,300	....	4,680
380	5,200	4,800	15,760	....	4,700	4,460	5,550	4,640
...	5,060	4,820	15,310	6,460	4,620	4,680	5,220	4,540
475	5,160	4,800	....	6,150	4,540	....	5,000	4,500
,100	5,060	4,920	12,300	5,970	4,480	4,520	5,000	....
,340	4,900	5,080	11,200	5,850	....	4,480	4,860	4,620
,240	....	....	10,675	5,120	4,700	4,440	4,900	4,600
,160	....	6,500	12,930	4,940	4,740	4,500	....	4,580
,160	....	6,340	....	....	....	4,560	4,940	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the year ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1885–86.												
1	4,640	......	5,870	6,360	8,580	9,575	15,640	7,450	5,040	4,580	......	4,480
2	4,480	5,950	5,710	10,850	8,440	7,975	27,800	......	5,100	4,600	4,560	4,500
3	4,600	7,840	5,475	......	7,500	7,575	29,400	6,870	4,920	4,500	4,580	4,440
4	......	12,700	5,080	10,450	7,275	7,575	......	6,870	4,820	......	4,580	4,400
5	4,520	10,150	5,200	10,240	6,890	7,350	16,200	6,500	5,000	......	4,640	......
6	4,400	8,350	......	24,600	6,320	6,950	13,925	6,525	......	4,560	4,600	4,540
7	4,580	7,250	5,400	26,450	......	......	17,680	6,420	4,820	4,600	4,620	4,500
8	4,800	......	4,800	15,610	5,810	6,675	......	6,300	4,740	4,500	......	4,320
9	4,640	8,440	4,800	9,225	5,650	6,300	16,520	......	4,480	4,560	4,600	4,400
10	5,120	15,730	5,140	......	5,710	6,340	14,740	8,400	4,580	4,440	4,620	4,300
11	......	15,190	8,440	7,975	5,650	6,050	......	8,025	4,540	......	4,500	4,440
12	4,500	11,740	10,050	7,760	6,050	6,100	14,740	7,600	4,480	4,500	4,460	......
13	4,540	9,525	......	6,930	10,700	6,250	13,625	7,675	......	4,500	4,480	4,640
14	4,720	8,300	8,400	6,950	......	......	13,170	7,125	4,800	4,480	4,440	4,320
15	4,720	......	9,725	6,360	31,600	6,625	14,410	6,750	4,620	4,540	......	4,340
16	4,800	6,975	9,600	6,625	28,000	6,725	15,820	......	4,660	4,580	4,480	4,280
17	4,780	6,770	8,175	......	22,700	6,625	16,200	7,625	5,160	4,560	4,560	4,240
18	......	6,250	7,400	6,500	18,640	7,000	......	8,500	5,020	......	4,480	4,660
19	4,800	5,950	7,025	5,990	15,850	7,500	14,440	7,675	4,760	4,840	4,520	......
20	4,640	5,910	......	5,950	15,190	7,720	14,860	7,075	......	4,560	4,480	4,600
21	4,620	6,400	6,250	5,730	......	......	14,950	6,525	4,720	4,540	4,460	4,540
22	4,780	......	5,670	5,850	12,250	6,725	13,820	5,990	4,660	4,640	......	4,540
23	7,175	5,770	5,810	5,950	10,970	9,000	12,900	......	4,680	4,700	4,520	4,480
24	7,600	5,625	6,480	......	9,925	8,500	11,710	5,910	4,560	4,520	4,580	4,360
25	......	5,670	......	6,625	9,150	8,125	......	5,930	4,520	......	4,400	4,600
26	5,850	......	6,360	5,360	8,900	8,025	9,800	5,280	4,800	4,520	4,420	......
27	5,000	6,300	......	5,600	8,440	8,075	8,810	5,380	......	4,500	4,200	4,600
28	4,780	6,050	5,020	5,890	......	......	8,200	5,990	5,020	4,560	4,340	4,560
29	4,900	......	5,220	6,150	......	9,775	7,840	6,175	4,600	4,520	......	4,600
30	4,820	5,910	5,340	7,175	......	10,575	7,600	......	4,580	4,540	4,320	4,620
31	5,140	......	5,240	......	......	12,775	......	5,770	......	4,600	4,480	......
1886–87.												
1	5,020	5,575	6,300	5,400	17,040	6,500	8,660	......	8,325	6,175	7,575	6,500
2	6,380	6,950	7,275	......	14,030	6,175	8,400	20,780	8,750	4,820	7,375	6,010
3	......	5,910	7,625	7,325	11,770	6,440	......	17,250	9,525	......	7,200	5,990
4	4,640	5,300	5,240	6,250	9,700	5,870	8,075	16,025	9,650	......	6,625	......
5	4,580	4,800	......	5,850	9,650	6,050	9,875	15,550	......	5,160	6,320	5,450
6	4,420	6,050	4,780	5,600	......	......	11,425	16,450	9,350	4,540	5,425	5,200
7	4,120	......	4,840	5,400	7,800	5,600	......	14,250	8,350	4,840	......	5,060
8	4,520	5,080	4,640	5,160	7,550	5,850	11,400	......	7,375	5,625	6,600	4,980
9	4,500	6,725	4,920	......	7,325	5,930	11,175	12,650	6,950	5,060	5,950	5,300
10	......	6,050	4,780	5,200	7,150	5,710	......	13,200	6,420	......	5,400	4,940
11	4,620	5,240	5,000	5,080	7,150	5,930	18,250	12,300	5,790	5,040	5,300	......
12	4,680	4,840	......	4,660	7,880	6,340	27,350	11,950	......	5,100	5,240	5,160
13	4,660	4,620	5,220	4,820	......	......	30,100	9,850	5,500	5,450	5,360	4,800
14	4,480	......	5,240	4,920	7,575	6,625	26,550	8,660	4,960	5,240	......	4,980
15	4,260	4,880	4,980	4,820	6,810	6,500	21,650	......	4,800	4,900	5,040	5,400
16	4,000	4,400	5,340	......	6,625	6,750	18,640	7,250	4,500	4,440	4,640	5,220
17	......	4,360	4,900	4,900	7,150	6,480	......	7,650	4,500	......	4,740	4,900
18	4,560	4,500	4,720	7,025	7,250	6,810	16,695	7,575	4,340	4,680	4,780	......
19	4,480	7,075	......	5,140	8,200	6,810	15,250	7,200	......	4,320	9,350	4,840
20	4,460	13,750	5,550	4,740	......	......	14,125	7,025	4,800	4,280	9,650	4,580
21	4,140	......	5,300	4,580	9,925	7,200	13,550	6,890	4,460	4,420	......	4,500
22	4,100	7,820	5,320	4,820	9,475	8,900	14,125	......	4,480	4,460	6,930	4,600
23	4,160	7,075	5,080	......	8,050	9,000	15,100	6,225	4,500	4,440	8,100	4,780
24	......	6,950	5,140	5,160	7,600	8,400	......	5,870	4,840	......	10,150	4,780
25	4,160	......	......	7,840	8,150	8,400	18,900	5,650	18,640	15,310	13,700	......
26	4,160	8,950	......	10,360	7,600	8,125	19,830	5,475	......	15,790	14,800	4,640
27	4,100	8,810	7,800	11,500	......	......	19,100	8,350	11,000	14,150	12,410	4,680
28	3,985	......	8,100	11,200	7,550	8,420	17,750	8,750	8,440	11,125	......	4,480
29	4,100	6,575	7,325	10,525	......	9,700	16,980	......	6,675	9,150	8,025	4,400
30	4,060	6,360	6,200	......	......	9,850	......	9,975	6,600	8,840	6,850	4,320
31	......	......	5,750	17 750	......	9,075	......	9,575	......	......	6,650	......

Merrimack River at Lowell, Mass., for the years -1861; 1866–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
5,410	8,975	....	30,250	10,250	....	5,010	4,930
5,350	8,775	19,200	28,200	10,150	5,960	5,010	....
5,330	8,150	20,000	23,510	....	5,110	5,010	5,210
5,610	....	18,650	18,450	8,675	....	4,970	4,930
....	10,250	....	16,900	7,840	5,370	....	4,930
5,510	6,800	19,200	....	7.540	5,130	4,950	4,930
5,530	6,610	24,000	14,850	7,200	5,010	4,950	4,930
5,490	6,750	....	15,250	6,950	....	4,950	4,790
5,775	6,400	21,700	15,500	7,350	5,350	4,950	....
5,775	6,590	19,300	16,750	....	5,170	4,970	5,150
5,610	....	17,550	18,700	6,570	4,950	5,050	5,490
....	6,590	17,300	19,050	6,200	4,750	....	5,210
5,725	6,020	17,250	....	6,200	4,650	5,170	5,010
5,510	5,900	17,200	28,550	5,940	9,375	5,210	5,150
5,590	5,850	....	25,200	5,850	....	5,190	5,190
6,100	6,610	15,500	20,850	5,850	5,210	5,330	....
5,470	6,710	15,500	18,000	....	4,950	5,250	4,930
5,210	....	16,300	15,450	6,140	4,910	4,950	5,190
....	7,100	17,050	13,500	5,675	4,910	....	6,590
5,610	6,500	17,100	....	5,250	4,950	5,110	9,600
6,180	6,950	18,050	12,050	5,250	5,010	4,990	8,900
8,625	10,950	....	10,825	5,170	....	5,050	13,230
10,125	14,250	16,850	10,700	5,170	5,150	5,190	....
11,500	17,000	17,100	10,325	....	5,050	5,250	13,650
11,875	....	16,850	10,300	5,390	4,990	5,190	10,750
....	14,000	15,200	10,175	5,900	4,950	....	10,825
10,775	12,750	15,150	....	7,840	4,990	5,230	13,650
10,950	13,100	16,100	12,410	6,525	4,950	4,990	16,100
10,325	14,700	....	9,400	6,550	....	4,990	12,050
....	16,600	25,300	11,160	6,060	5,190	4,990	....
....	21,400	....	11,040	....	4,990	4,930	....
8,000	5,250	8,725	11,040	5,900	5,150	6,800	....
7,720	5,250	9,125	9,775	....	5,170	6,525	5,010
....	....	9,775	8,775	7,000	5,010	9,900	4,950
7,520	5,700	....	8,300	9,725	....	....	4,970
7,080	6,120	10,400	....	7,975	5,470	8,325	4,910
7,200	8,700	11,100	7,560	7,560	5,470	8,000	4,950
7,760	14,850	....	7,320	7,320	....	7,560	7,040
7,350	16,400	10,000	6,925	6,650	5,190	7,100	....
7,290	14,200	9,725	6,750	....	5,090	6,710	5,150
....	....	9,725	6,690	7,290	5,010	6,450	4,810
7,560	9,875	10,025	6,160	7,560	4,950	....	4,750
6,570	8,950	5,330	....	8,675	5,010	6,220	4,850
6,710	8,775	10,050	6,450	8,150	4,850	5,530	4,830
7,540	9,100	....	5,980	7,410	....	5,410	4,810
6,825	9,300	9,775	6,060	6,825	5,010	5,430	....
6,240	9,325	8,875	6,325	....	4,950	5,750	5,010
....	....	8,525	6,160	6,240	4,850	6,080	5,050
7,000	9,100	8,825	6,040	6,160	4,930	....	5,110
7,080	9,350	9,025	....	6,160	4,810	5,610	6,300
7,040	10,550	9,025	5,510	6,100	4,810	5,450	7,540
6,875	10,750	....	5,630	6,000	....	5,410	9,150
6,900	10,350	10,900	7,860	5,250	9,400	5,430	....
6,475	10,225	10,150	10,550	....	7,260	5,270	7.000
....	....	8,950	9,025	5,310	6,300	5,050	6,875
6,300	10,700	7,900	7,580	4,970	6.040	....	6,220
6,350	11,160	7,290	....	4,990	5,150	5,230	6,060
5,310	10,350	8,275	6,750	5,110	5,010	5,150	5,900
5,390	9,675	....	6,325	5,150	....	5,050	5,940
....	9,550	13,500	6,750	4,850	5,650	4,850	....
....	9,400	12,900	6,650	....	5,350	5,010	6,020
....	....	....	6,240	....	5,200	5,210	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the yea ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1889–90.												
1	5,410	7,580	....	7,600	6,260	15,750	11,425	10,225	....	5,090	5,110	....
2	5,270	7,200	11,900	7,860	....	....	10,950	10,670	9,250	5,150	4,930	7,7
3	7,800	....	10,460	8,750	6,710	13,230	....	10,610	8,400	5,250	....	6,7
4	7,350	8,350	9,750	9,450	6,160	11,100	11,475	....	8,025	....	4,650	6,2
5	6,550	13,410	8,350	....	6,900	10,375	14,700	10,275	7,700	....	4,530	5,8
6	....	10,700	7,680	8,375	7,950	8,900	....	14,700	8,850	....	4,470	5,6
7	6,350	9,125	7,950	8,100	8,425	6,590	16,800	16,600	10,950	5,700	4,470	....
8	9,325	8,125	....	8,475	7,950	7,680	16.250	18,500	....	5,390	4,390	5,4
9	11,475	7,660	8,500	7,950	....	....	16,400	14,900	9,850	5,090	4,310	5,1
10	9,325	....	15,650	6,750	11,950	7,900	16,700	12,300	8,800	5,150	....	5,3
11	7,860	6,950	16,700	6,750	10,750	7,840	17,000	....	8,075	5,150	4,930	5,4
12	7,350	6,875	15,000	....	9,250	8,150	16,500	12,440	7,230	5,090	4,890	5,8
13	....	6,630	14,600	6,710	8,650	9,650	....	11,650	7,780	....	4,850	6,3
14	7,260	6,800	12,350	6,925	7,900	14,200	14,900	10,400	9,225	5,150	4,810	....
15	7,290	7,120	....	7,600	8,525	16,300	16,600	10,400	....	5,010	4,890	10,4
16	7,260	7,080	8,350	7,975	....	....	18,600	12,470	8,850	5,070	4,850	10,9
17	6,610	....	8,900	9,850	9,500	13,600	16,600	11,900	8,150	4,890	....	10,9
18	6,400	6,550	9,125	9,075	9,125	12,500	14,400	....	7,680	5,010	4,810	13,4
19	6,300	6,080	9,575	....	8,150	11,590	13,080	9,925	7,320	4,850	4,810	17,4
20	....	6,570	13,380	8,250	7,160	10,300	....	9,200	6,670	....	4,890	14,4
21	6,300	8,525	14,100	8,625	7,290	10,175	11,130	10,200	6,650	5,050	4,970	....
22	6,060	9,775	....	8,975	7,120	10,800	10,875	13,650	....	4,970	4,930	9,40
23	5,725	10,490	11,650	8,600	....	....	10,580	10,825	6,280	4,850	5,150	8,07
24	5,410	....	10,800	7,410	6,750	18,050	10,640	9,400	6,000	4,890	....	7,60
25	5,450	9,325	....	7,100	7,040	16,500	11,375	....	5,430	4,810	5,130	7,10
26	5,430	8,350	11,130	....	7,925	14,500	11,875	7,860	5,570	4,950	5,410	6,59
27	....	7,900	11,300	7,140	14,250	15,100	....	7,740	5,610	....	4,610	6,24
28	5,775	....	9,875	7,290	15,750	15,200	12,270	13,900	5,290	6,350	4,650	....
29	7,000	16,700	....	6,325	....	14,300	11,300	17,700	....	6,060	10,460	6,75
30	8,575	16,750	6,375	6,710	....	....	10,980	14,250	5,330	5,650	8,025	6,37
31	8,400	....	10,640	6,590	....	11,975	....	11,875	....	5,150	....	....
1890–91.												
1	6,240	11,550	7,080	5,650	....	....	17,900	9,675	6,200	4,890	6,200	4,85
2	6,200	....	6,280	5,550	10,750	14,850	....	8,600	5,750	4,850	....	5,69
3	6,060	9,475	5,570	5,370	10,950	12,825	16,400	....	6,020	4,750	5,010	4,59
4	6,000	9,525	5,310	....	11,160	10,950	16,400	8,900	6,220	....	4,750	4,55
5	....	8,925	5,350	6,200	11,250	9,775	....	8,900	6,950	....	4,710	4,43
6	6,950	8,925	5,370	5,675	9,900	9,925	15,000	8,475	7,740	5,050	4,810	....
7	6,800	8,100	....	5,550	9,450	9,925	14,500	7,925	....	4,810	4,770	....
8	6,425	8,025	5,940	5,550	....	....	13,600	7,660	6,350	4,910	4,810	4,69
9	7,200	....	5,450	5,550	8,900	9,600	12,990	7,160	5,850	4,850	....	4,65
10	7,600	7,600	5,450	5,450	8,250	11,190	12,725	....	5,450	5,010	4,690	4,69
11	7,440	7,560	5,310	....	8,725	18,300	12,990	6,550	4,970	4,950	4,590	4,65
12	....	7,600	5,450	6,825	9,400	20,450	....	7,100	4,950	....	4,510	4,69
13	6,690	7,640	5,900	8,400	8,575	20,000	22,050	7,600	4,970	4,850	4,510	....
14	6,240	7,380	....	11,650	8,250	22,800	24,450	7,440	....	4,810	4,350	4,65
15	6,300	7,200	5,650	11,450	....	....	22,550	6,950	5,150	4,770	4,350	4,69
16	6,375	....	5,250	11,100	7,540	21,900	23,300	6,425	5,050	4,690	....	4,490
17	7,540	7,260	5,350	9,875	8,150	17,700	22,300	....	4,870	4,690	4,610	4,490
18	13,750	8,025	5,410	....	10,275	15,500	19,700	9,900	4,810	4,730	4,510	4,350
19	....	11,250	6,300	8,850	11,160	14,600	....	8,525	4,750	....	4,450	4,510
20	18,850	12,025	6,220	8,200	11,500	13,350	20,800	7,600	5,530	4,890	4,450	....
21	23,700	10,400	....	8,000	10,490	12,620	20,800	6,975	....	5,700	4,450	4,490
22	21,300	9,075	6,100	7,950	....	....	17,900	6,570	5,590	4,990	4,390	4,510
23	16,900	....	5,550	11,375	10,025	21,500	15,300	6,950	5,290	4,770	....	4,330
24	13,900	7,700	5,725	14,000	10,025	29,900	15,650	....	6,650	4,730	5,450	4,390
25	13,850	7,380	....	....	10,400	32,000	16,000	6,550	6,670	4,690	4,690	4,270
26	....	7,410	6,140	15,000	13,950	29,900	....	6,375	6,000	....	4,550	4,205
27	13,950	....	5,550	12,900	21,000	24,300	10,750	6,220	5,900	5,050	4,410	....
28	12,590	7,000	....	11,770	20,850	20,250	10,150	5,510	....	4,810	4,420	4,175
29	11,070	6,750	6,000	10,520	....	....	9,900	5,350	5,290	4,850	4,510	4,250
30	10,850	....	6,000	9,975	....	18,400	9,900	5,410	5,190	4,750	....	4,250
31	11,925	....	5,410	9,700	....	22,900	....	....	....	4,810	5,450	....

Merrimack River at Lowell, Mass., for the years
–1861; 1866–1915—Continued.

	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	5,900	7,860	8,650	......	8,850	8,525	4,610	7,200
	5,900	4,850	8,500	5,650	8,775	7,740	4,510	7,000
	5,650	5,250	......	5.050	7,600	......	4,510	6,080
	5,700	4,790	11,300	6,240	7,200	......	4,450	......
	6,100	4,745	13.500	7.470	......	11,590	4,390	......
	5,900	......	13,800	8,900	6,500	10,350	4,330	5,350
	......	4,810	......	7,540	6,200	8,575	......	4,770
	5,850	5,010	12,775	......	6,220	7,040	4,510	4,790
	5,590	5,725	10,150	6,200	6,200	6,650	4,350	4,790
	5,150	6,750	......	5,550	5,700	......	4,330	4,790
0	5,090	9,400	8,275	5,350	5,900	5,920	4,310	......
0	5,010	9,225	7,800	5,210	......	5,570	4,350	4,650
0	5,350	......	7,320	5,960	5,550	4,850	5,050	4,450
0	......	8,650	6,590	7,440	4,670	4,790	......	4,450
0	4,990	6,750	6,550	......	4,750	4,750	6,140	4,650
00	5,050	6,950	6,060	7,800	4,670	4,710	6,200	7,925
..	4,930	6,425	......	8,975	4,610	......	5,450	7,000
75	4,910	6,140	6,040	8,775	4,490	4,950	4,350	......
50	4,910	6,000	5,875	7,600	......	4,770	4,410	5,700
75	4,890	......	5,250	6,730	5,050	4,350	4,390	4,550
50	......	5,725	5,150	7,580	4,610	4,550	......	4,630
75	4,930	5,250	5,010	......	4,490	4,650	4,690	4,550
00	4,950	5,410	5,570	17,850	4,590	4,450	4,490	4,650
..	4,850	5,700	......	20,550	4,610	......	4,450	4,570
00	5,170	7,100	6,550	19,750	4,570	4,570	4,470	......
200	5,650	7,700	5,980	15,500	......	4,510	4,430	4,630
040	5,610	......	5,775	12,900	8,925	4,510	6,650	4,235
040	......	9,275	5,490	11,500	8,700	4,490	......	4,350
750	6,160	8,925	5,490	......	10,100	4,490	15,300	4,530
960	......	8,825	5,490	9,975	10,800	4,390	11,620	4,470
...	......	8,650	......	8,825	......	......	8,975	......
...	5,500	6,400	11,340	13,950	9,075	6,150	5,660	8,325
950	5,300	6,275	......	15,150	8,790	......	5,620	6,750
600	5,560	6,050	14,670	16,050	8,690	......	5,400	......
,660	6,150	6,275	14,190	19,100	......	......	4,810	......
,675	......	......	13,620	35,500	8,060	6,275	4,810	7,250
,275	6,150	6,600	......	36,200	7,625	6,200	......	5,950
,725	6,050	6,130	14,760	......	7,800	6,050	4,850	4,690
....	5,900	6,150	13,800	23,900	7,750	6,070	4,910	5,500
,400	6,560	6,090	......	20,000	7,625	......	5,480	4,610
,175	6,850	6,275	16,200	17,500	7,200	6,350	4,390	......
,275	9,075	6,850	17,500	16,450	......	6,090	5,225	5,990
,900	......	......	16,200	17,000	7,400	6,090	4,100	5,175
5,700	11,750	9,625	17,000	17,050	6,560	5,850	......	6,275
6,200	9,625	12,650	17,850	......	7,175	5,725	6,050	5,175
.....	8,950	18,050	18,200	18,300	6,750	5,660	4,970	6,275
6,275	8,400	20,350	......	16,700	6,500	......	5,400	5,050
5,950	8,850	19,650	17,500	17,800	6,600	5,950	4,310	......
5,600	8,850	17,500	15,990	26,650	......	5,660	5,250	6,500
5,500	......	......	14,250	26,800	7,125	5,420	4,175	5,900
5,700	8,100	12,830	13,800	22,100	6,650	5,380	......	5,850
5,825	7,340	11,800	13,440	......	6,560	5,400	5,060	6,050
......	6,600	10,925	14,700	15,450	6,460	5,175	4,550	6,010
6,090	6,500	10,650	......	14,010	6,130	......	6,150	5,750
5,400	6,500	9,675	14,700	12,650	6,400	5,580	4,710	......
5,750	6,440	9,950	14,190	12,310	......	5,150	6,275	6,110
5,300	......	......	14,250	11,625	7,150	5,125	4,830	5,700
4,990	6,420	14,700	13,500	10,350	7,050	5,050	......	6,030
6,010	7,050	14,010	13,710	......	6,560	5,075	7,010	4,950
......	......	13,440	13,200	9,875	6,520	5,010	5,750	5.600
6,150	......	12,160	......	9,200	6,275	......	7,175	4,810
5,700	......	11,600	......	9,075	......	5,750	8,750	......

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the year ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1901-2.												
1	5,150	6,000	....	22,700	8,250	22,300	25,100	18,300	....	7,000	6,700	....
2	5,150	6,300	6,550	17,800	....	....	22,100	24,800	8,600	7,200	6,300	6,40
3	5,150	....	6,000	14,500	9,350	54,500	18,300	18,700	8,200	7,100	....	5,45
4	5,700	6,650	5,750	10,900	9,800	55,600	15,600	....	8,000	....	6,300	5,35
5	5,950	5,900	5,500	....	8,900	38,000	13,400	14,200	7,800	....	5,800	5,10
6	....	5,850	5,550	9,300	8,550	24,400	....	13,700	7,650	....	5,350	5,45
7	6,200	5,900	5,500	8,550	8,100	19,000	10,900	13,500	7,350	7,650	5,500	....
8	5,150	5,900	....	8,200	7,900	17,300	11,000	12,600	....	7,550	5,750	5,80
9	5,000	6,450	6,200	8,050	....	....	13,200	12,400	7,650	7,450	6,800	5,30
10	4,850	....	6,100	8,000	7,300	15,200	31,500	11,100	7,000	7,000	....	5,15
11	5,200	6,500	6,950	7,350	7,200	16,500	36,400	....	7,200	6,950	6,750	5,85
12	5,700	5,350	7,200	....	7,000	16,700	32,500	9,600	7,100	6,650	7,300	7,20
13	....	5,300	8,350	8,100	7,000	21,500	....	9,050	6,350	....	9,550	7,00
14	5,850	5,550	8,100	7,300	6,850	30,800	17,300	8,750	6,750	6,900	8,450	....
15	6,900	6,450	....	7,000	6,700	30,800	18,100	8,350	....	5,700	7,650	7,20
16	13,450	7,000	35,800	7,200	....	....	15,700	8,050	7,000	5,700	7,150	7,25
17	11,600	....	37,700	7,200	7,000	23,000	13,600	7,750	5,850	6,100	....	7,10
18	9,400	7,000	20,700	7,150	6,300	32,000	12,900	....	8,500	6,150	7,100	7,10
19	7,450	5,950	13,800	....	6,350	31,000	....	7,750	8,250	5,700	5,900	6,10
20	....	5,950	11,000	7,200	6,450	23,000	....	7,700	7,700	....	5,800	7,20
21	7,550	6,100	9,000	6,650	6,650	19,800	11,000	7,850	7,250	7,000	5,700	....
22	6,900	....	....	7,400	6,450	20,700	11,400	7,700	....	7,000	6,000	7,10
23	6,750	6,650	6,750	16,200	....	....	10,800	7,550	7,550	7,250	6,200	6,45
24	6,550	....	7,350	21,700	6,650	21,500	10,900	7,100	7,400	7,450	....	6,70
25	7,000	6,800	....	18,400	6,300	19,700	10,900	....	7,150	7,750	7,600	6,90
26	6,550	6,650	8,400	....	6,550	17,200	10,000	7,700	6,450	7,100	7,200	6.55
27	....	6,550	8,400	12,300	7,700	15,400	....	8,500	7,000	....	6,850	6,75
28	6,750	....	....	12,500	11,950	14,200	16,500	11,550	8,700	7,050	6,650	....
29	6,300	6,900	....	11,000	....	13,900	14,500	14,850	....	6,500	5,800	7,10
30	6,050	6,750	15,000	9,700	....	....	12,500	....	7,350	6,450	7,000	8,20
31	6,100	....	25,100	9,300	....	29,100	....	10,650	....	6,550	....	....
1902-3.												
1	10,650	12,700	7,450	9,400	9,500	15,700	23,800	7,200	4,900	9,550	6,550	5,70
2	10,000	....	7,450	9,400	10,550	23,900	24,300	7,300	5,550	8,950	4,000	5,70
3	9,200	9,600	7,300	9,250	10,000	24,200	20,700	6,700	5,350	8,600	7,250	6,45
4	7,500	9,500	7,550	9,600	10,250	20,200	19,000	6,550	5,050	....	6,150	5,80
5	....	8,700	7,900	11,500	11,850	16,700	....	6,250	5,250	5,600	6,100	5,25
6	8,100	8,550	7,300	11,500	12,600	15,800	20,300	6,350	5,250	7,900	6,600	....
7	9,300	8,350	....	11,100	11,450	14,700	17,000	6,450	800	7,250	7,000	....
8	10,000	8,350	7,100	10,160	9,450	14,300	15,900	6,350	6,050	6,750	7,050	6,55
9	8,800	....	7,200	9,550	8,950	20,600	18,300	6,150	5,450	6,900	4,050	5,70
10	8,000	8,150	6,900	8,600	8,900	30,400	20,700	5,800	5,400	7,150	7,000	5,35
11	7,700	7,850	6,550	7,650	9,100	34,400	20,200	5,850	5,450	7,000	6,000	4,90
12	....	7,750	6,700	8,500	9,650	41,400	17,100	5,550	5,700	3,750	5,950	5,55
13	8,000	7,650	6,950	8,450	12,750	42,400	15,400	5,400	5,700	6,750	6,000	70
14	8,100	7,900	....	8,350	14,150	37,100	13,950	5,300	15,300	6,450	6,650	5,80
15	7,950	7,000	6,900	8,000	12,900	30,200	12,900	5,100	15,700	6,350	7,000	5,15
16	7,900	....	6,650	8,100	12,100	27,600	13,950	5,050	15,800	6,450	3,050	5.20
17	7,800	8,050	7,600	7,550	10,550	23,800	16,600	....	16,300	5,900	6,750	5,05
18	7,650	7,750	9,900	7,100	9,800	21,100	16,300	5,050	13,300	6,450	5,700	5,05
19	....	7,950	13,050	9,200	10,350	20,000	13,900	4,400	10,800	3,550	5,500	5,80
20	7,500	7,650	12,250	8,000	9,350	19,400	12,750	4,550	9,200	6,700	5,400	....
21	7,550	7,550	....	8,000	8,500	22,100	11,850	4,450	10,850	6,450	5,450	5,950
22	8,250	7,450	11,450	8,300	7,800	27,300	10,950	4,250	26,200	7,900	6,750	5,050
23	7,850	....	18,500	9,500	9,050	29,400	10,050	4,200	34,800	9,000	3,800	5,050
24	7.750	7,550	21,000	9,550	8,950	34,800	9,900	3.050	29,300	8,500	6,500	5,050
25	7,200	7,450	....	8,400	8,800	36,100	9,350	4,300	22,700	7,900	5,850	5,000
26	....	7,450	14,100	8,700	8,750	35,000	8,350	3,050	18,900	5,800	5,950	5,700
27	7,800	....	12,400	8,350	8,800	27,700	7,600	3,100	15,900	7,550	6,450	....
28	7,350	7,550	....	8,100	8,700	21,800	7,300	4,500	12,550	7,150	6,650	5,700
29	20,200	7,400	10,250	8,200	....	19,700	7,150	4,250	11,150	6,800	6,750	4,800
30	25,800	....	10,050	8,500	....	....	....	....	9,950	6,750	3,150	4,850
31	17,200	....	9,700	8,950	....	....	....	2,750	....	6,600	6,650	....

ferrimack River at Lowell, Mass., for the years
-1861; 1866–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
8,000	....	19,700	9,325	7,625	5,420	5,250	4,810
....	66,300	20,600	8,660	7,625	4,930	....	4,250
7,550	73,400	20,050	....	7,600	4,890	5,075	4,115
7,300	34,400	17,500	8,450	7,625	....	5,125	3,940
7,100	20,400	....	8,100	6,500	....	4,910	4,610
7,100	17,200	13,800	8,510	6,800	5,620	4,710	....
13,025	16,600	13,350	8,325	....	5,300	5,175	....
23,200	....	12,950	8,080	6,930	5,400	5,250	7,300
....	13,650	12,160	7,875	6,440	5,175	....	7,800
18,000	12,100	12,650	....	6,150	5,380	4,550	7,625
14,550	12,450	13,230	7,800	7,875	6,130	5,275	7,175
13,200	11,175	....	7,500	8,080	....	4,850	7,200
11,520	9,725	15,900	7,420	7,500	7,925	5,320	....
10,440	10,350	19,500	7,360	....	5,225	5,250	7,010
9,900	....	23,900	7,300	7,550	5,075	5,100	6,110
....	9,875	22,450	7,300	6,600	5,010	....	6,600
9,825	8,870	24,500	....	6,600	4,870	5,380	6,600
8,140	9,900	26,000	7,500	6,600	4,810	5,300	6,150
8,060	9,975	....	6,850	6,520	....	4,850	6,700
8,000	13,890	....	6,150	6,775	5,460	4,130	....
8,325	20,500	19,900	6,400	....	4,850	4,040	7,030
8,325	....	17,850	6,500	6,580	4,830	4,690	7,225
....	20,350	15,750	6,890	6,600	5,500	....	7,100
7,850	17,700	14,190	....	6,050	6,050	5,300	6,890
8,040	15,060	12,800	6,990	5,520	6,440	5,200	6,375
8,200	14,040	....	6,150	5,460	....	5,050	6,650
8,100	15,900	10,950	6,050	5,775	6,050	4,610	....
8,100	17,500	10,350	6,400	....	5,480	4,510	6,400
8,450	....	9,950	6,600	5,900	5,100	4,750	5,875
....	16,850	9,750	6,950	5,600	5,050	....	5,460
....	17,500	....	....	....	....	5,010	....
7,950	7,300	15,900	12,300	11,250	9,000	....	7,450
7,450	7,000	16,200	....	10,650	10,350	11,250	7,750
7,300	7,250	16,900	12,750	10,050	9,550	10,600	8,250
7,150	8,000	....	13,500	10,200	....	9,600	9,950
7,200	9,300	16,900	14,200	11,400	....	9,600	....
7,650	9,800	19,000	14,050	....	8,750	10,100	....
....	....	21,200	12,650	12,200	8,650	9,800	7,950
8,900	11,850	22,700	11,850	11,250	8,800	....	7,000
10,650	11,200	22,400	....	10,550	9,650	9,300	7,000
12,300	11,000	24,100	10,450	14,550	9,300	10,100	6,950
11,950	12,000	....	9,950	35,900	....	10,250	7,600
10,650	14,100	21,300	10,450	34,900	8,500	9,100	....
9,450	15,000	18,300	11,200	....	8,650	10,650	7,400
....	....	17,100	15,500	21,400	19,300	10,500	6,950
8,800	12,750	16,700	26,200	19,700	34,000	....	6,950
8,700	11,150	19,200	....	18,100	41,100	10,650	6,400
9,200	10,500	23,300	15,600	16,000	26,800	10,300	6,300
8,550	10,250	....	13,400	14,400	....	10,300	7,550
9,050	10,500	....	11,850	12,950	15,800	10,950	....
8,900	11,400	19,100	11,050	....	13,850	10,650	7,100
....	....	18,000	10,450	12,400	12,600	10,600	6,900
9,000	14,750	15,800	10,000	12,600	12,350	....	6,700
8,800	15,100	14,600	....	11,650	11,800	10,850	6,400
8,200	17,700	14,000	9,250	10,500	12,200	8,700	6,100
8,400	19,200	....	9,200	9,950	....	9,450	7,450
8,200	18,500	16,900	9,450	9,750	14,700	11,000	....
7,450	16,700	18,200	10,600	....	14,350	11,000	7,250
....	....	16,400	10,850	9,200	13,100	10,750	6,600
....	12,700	14,050	12,060	8,650	12,100	....	6,500
....	13,500	12,950	....	8,650	12,800	10,350	6,450
....	14,800	....	....	....	13,450	8,550	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the yea ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1905–6.												
1	3,750	5,500	7,050	8,300	7,850	7,900	15,400	9,400	20,700	7,450	7,750	6,1
2	6,500	5,500	6,750	8,000	7,900	7,650	14,000	9,350	15,700	10,300	10,800	1,9
3	6,300	5,800	5,050	7,400	7,300	7,200	12,300	9,650	13,400	10,150	7,400	2,1
4	6,250	6,450	10,050	7,400	4,700	6,750	11,550	9,750	13,050	8,300	6,550	5,5
5	6,300	3,000	15,300	7,550	7,300	11,400	11,950	10,150	11,850	10,200	4,750	5,0
6	6,200	6,500	11,300	7,400	7,200	10,350	14,150	8,550	10,500	10,450	7,200	5,0
7	6,700	6,600	9,950	6,050	7,950	9,700	16,700	10,050	10,100	8,500	7,150	5,0
8	2,750	7,300	8,800	7,550	6,750	9,050	13,650	9,950	12,100	6,900	6,750	4,7
9	6,250	7,400	7,750	7,450	6,750	8,700	13,050	9,400	12,350	7,900	7,100	.....
10	5,550	7,100	6,000	7,350	6,650	8,950	13,150	9,300	11,300	7,400	7,000	4,9
11	5,550	6,650	7,450	7,300	2,950	6,550	14,150	11,100	11,400	7,400	6,100	4,9
12	5,650	4,000	6,900	7,200	6,750	8,700	17,300	10,400	10,650	7,450	3,200	4,8
13	5,600	7,000	7,000	6,950	6,800	8,300	18,700	8,550	9,550	7,450	7,000	4,5
14	6,100	6,250	7,200	4,850	6,750	8,350	18,200	9,250	8,550	6,500	6,300	4,3
15	4,150	6,400	7,200	7,350	6,650	7,700	18,100	10,150	8,000	4,200	5,700	4,5
16	6,150	6,500	6,750	7,400	6,450	7,450	27,500	9,050	7,400	7,350	5,700	.....
17	6,100	6,700	3,450	7,800	6,300	6,000	35,400	8,500	6,800	6,500	5,550	4,8
18	6,100	6,350	7,200	8,250	3,650	4,900	29,500	8,600	13,950	6,550	5,700	4,6
19	6,100	3,400	6,500	8,000	6,650	6,750	22,900	8,850	16,200	6,900	1,400	4,3
20	6,100	6,500	6,550	7,050	6,500	6,900	20,300	7,600	14,000	6,900	5,900	4,3
21	6,100	6,300	7,300	....	6,500	7,000	17,800	8,500	13,250	6,300	5,500	4,2
22	3,700	6,000	7,200	7,700	7,550	7,100	16,500	7,800	10,300	3,800	5,050	4,4
23	6,550	6,000	7,200	8,350	8,950	7,300	17,000	7,150	9,050	6,550	5,050	.....
24	6,250	5,850	6,300	14,150	8,800	6,700	15,200	7,100	8,150	6,500	5,150	4,6
25	6,300	6,250	5,900	24,700	7,600	4,000	12,900	7,100	11,900	7,150	5,450	4,6
26	6,250	1,650	7,500	17,200	9,050	7,350	11,550	6,900	12,600	7,200	750	4,5
27	6,350	6,450	7,200	13,200	10,450	7,300	10,600	7,000	10,800	7,100	5,250	4,5
28	6,400	6,150	7,200	9,750	9,150	9,250	9,550	13,450	9,450	6,550	5,400	4,5
29	2,700	6,100	7,150	8,700	....	17,100	8,350	37,500	8,350	3,150	5,250	4,4
30	6,100	1,400	6,800	8,300	....	17,600	9,400	38,400	7,750	6,500	5,250	.....
31	6,050	....	7,000	7,900	....	16,300	....	28,300	....	6,550	5,600	.....
1906–7.												
1	4,550	6,500	6,650	6,550	5,900	5,250	25,400	14,000	7,050	6,300	5,800	2,7
2	4,550	5,700	2,950	9,050	6,550	5,900	20,700	17,200	5,050	6,750	5,700	1,4
3	4,550	6,150	7,150	9,750	3,450	400	16,200	14,400	7,650	7,300	6,100	4,8
4	4,500	....	6,650	9,450	7,100	6,550	13,750	11,300	8,600	4,100	....	4,8
5	4,500	6,300	4,800	9,200	6,550	5,600	12,550	9,950	9,650	5,200	5,600	5,0
6	4,400	5,700	4,800	8,700	6,100	5,550	12,500	11,000	9,550	4,350	5,550	5,1
7	....	5,600	4,900	9,250	6,100	5,700	11,950	10,300	10,800	3,400	5,600	4,5
8	4,300	5,200	5,750	8,950	5,900	5,600	11,750	9,950	10,500	6,950	5,550	.....
9	4,300	4,900	200	8,750	6,850	5,850	11,100	9,750	....	6,500	5,550	5,1
10	4,400	4,550	5,450	8,250	2,750	1,150	10,500	9,800	8,750	6,700	6,300	5,4
11	5,100	....	5,400	7,950	6,800	6,450	10,300	9,050	8,300	6,450	....	5,3
12	4,750	5,450	5,250	7,250	6,300	5,700	10,400	8,150	8,050	6,450	5,450	5,2
13	5,200	5,550	5,350	5,100	6,100	5,600	11,050	9,100	7,900	6,350	5,350	5,2
14	1,750	6,000	5,400	7,700	6,100	5,700	11,150	8,600	8,100	4,100	5,350	6,5
15	5,600	6,000	5,450	7,350	6,000	6,150	12,100	8,300	7,000	6,750	5,050	2,9
16	5,700	6,800	300	7,150	6,350	7,000	12,350	9,050	4,550	6,900	4,400	5,7
17	5,150	6,950	5,700	7,200	1,150	4,400	12,250	9,300	7,450	6,600	4,150	5,4
18	5,100	1,250	5,500	7,150	6,800	9,000	11,700	13,050	7,400	6,250	....	5,2
19	4,700	6,300	7,750	6,550	6,150	10,300	10,850	11,700	7,350	6,200	4,450	5,0
20	4,450	5,950	5,500	4,450	6,050	10,050	10,200	10,900	6,750	6,350	4,450	5,1
21	....	7,300	5,500	7,800	6,050	9,300	9,050	9,900	6,700	....	4,450	5,5
22	4,800	7,650	6,300	7,700	6,100	9,350	9,700	9,100	6,550	6,450	4,450	.....
23	5,700	7,550	450	7,750	6,450	9,050	8,250	8,500	3,000	5,900	4,500	5,1
24	6,000	7,150	6,800	7,800	650	11,800	9,500	8,050	6,750	5,900	2,700	4,9
25	5,950	4,450	650	7,550	6,800	13,450	13,600	7,250	6,550	5,400	250	7,7
26	5,900	7,450	5,900	7,150	5,900	12,800	17,000	5,350	6,050	5,500	2,600	8,0
27	6,050	7,300	5,800	4,000	5,400	12,450	13,300	7,650	5,900	6,300	2,700	7,1
28	4,300	7,150	6,200	7,700	5,400	12,500	15,300	7,750	5,900	1,800	3,200	6,5
29	6,750	2,600	6,600	6,950	....	14,200	15,000	8,100	6,000	5,850	3,150	4,9
30	6,550	7,300	450	7,000	....	17,900	14,000	8,000	3,100	5,800	3,250	13,4
31	6,350	....	5,950	6,800	....	22,200	....	7,900	....	5,850	3,100	.....

Merrimack River at Lowell, Mass., for the year –1801; 1866–1915—Continued.

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
6,468	6,924	21,005	16,070	13,980	6,252	5,056	5,748
6,060	8,950	18,205	17,330	14,340	5,079	95	5,820
9,525	8,875	16,280	18,100	11,640	4,800	6,132	5,748
8,500	9,075	14,130	17,855	10,025	219	5,940	5,010
8,375	8,825	11,375	18,660	8,925	2,024	5,940	4,700
8,175	7,925	11,790	16,245	8,125	6,132	6,420	47
6,300	7,750	11,940	14,070	6,252	5,940	10,800	278
6,372	6,468	13,110	14,100	8,750	5,892	8,000	5,700
7,625	9,125	14,730	19,955	8,375	5,868	6,444	5,820
8,250	9,125	14,370	20,655	8,375	5,424	7 188	5,700
7,875	9,175	13,830	19,430	8,375	5,820	6,660	5,355
7,800	9,175	14,280	16,770	8,000	77	6,660	4,700
7,625	9,300	14,880	15,030	7,212	5,585	6,420	34
5,940	12,180	13,380	14,580	3,743	5,401	6,012	5,493
6,468	13,290	12,180	14,610	7,625	5,355	5,516	5,240
20,480	19,220	11,700	14,220	7,750	5,355	3,376	5,125
25,030	21,005	12,540	12,780	6,420	4,640	6,612	4,800
22,160	18,800	11,350	12,450	6,420	4,400	6,420	4,540
15,540	15,840	10,800	11,580	7,140	39	6,012	4,500
11,050	12,930	12,330	10,925	6,900	5,470	5,654	33
9,900	11,580	13,680	10,550	3,466	5,892	5,401	4,300
9,125	10,200	12,150	9,775	6,180	8,125	4,800	3,466
8,450	11,730	12,060	9,850	6,132	7,875	....	3,466
9,175	12,930	10,550	10,300	6,132	6,780	6,852	3,430
8,700	20,025	11,460	11,100	6,132	6,468	6,300	3,430
8,750	20,130	....	10,150	5,820	2,926	6,108	3,430
9,100	18,345	14,370	9,500	4,800	7,212	6,060	63
8,550	20,340	16,980	9,175	756	7,260	5,820	4,040
8,000	21,530	17,750	8,500	6,420	6,300	5,654	4,020
....	24,365	20,235	....	6,300	6,060	35	4,200
....	24,225	....	....	....	5,240	6,036	....
6,300	11,375	15,780	12,870	8,250	5,700	22	2,980
5,516	10,500	15,510	12,630	8,125	5,148	4,905	3,286
5,539	10,025	15,210	14,250	7,875	5,240	4,660	3,860
5,424	9,700	14,670	13,530	7,950	41	4,620	3,840
5,355	9,475	14,580	12,390	7,500	1,735	4,660	29
5,378	8,750	16,035	12,780	4,080	5,820	4,700	784
3,106	6,036	19,080	11,888	8,325	5,608	4,440	2,805
6,660	9,050	24,155	12,120	8,750	5,654	20	....
6,708	8,325	26,950	11,200	8,250	6,300	4,600	4,500
7,332	8,250	22,930	12,330	8,125	5,940	4,660	4,200
8,325	9,250	17,155	12,480	7,825	20	4,500	4,080
8,400	8,925	14,280	13,140	7,875	5,240	4,460	30
8,125	9,125	12,630	11,888	4,400	5,240	4,460	4,600
6,348	6,612	13,080	10,375	7,500	5,194	4,300	4,580
8,375	9,250	26,430	9,450	7,625	4,800	5	4,540
8,375	8,450	40,510	8,125	7,625	4,863	4,460	4,540
8,075	9,000	36,556	9,400	7,116	4,660	4,100	4,500
7,260	8,875	28,030	11,430	6,900	40	4,360	4,400
7,950	8,700	23,665	11,200	7,140	4,968	4,500	21
8,075	7,625	20,655	10,875	6,972	4,926	4,460	4,260
10,425	5,355	24,155	10,300	7,750	4,947	4,620	3,840
14,130	8,375	19,780	9,525	7,500	4,947	30	3,860
14,280	8,125	18,275	7,700	7,625	4,947	4,620	3,860
13,740	8,250	18,100	9,125	7,575	4,740	4,660	3,840
16,980	8,500	14,970	8,925	6,948	37	4,620	3,940
16,980	19,255	13,890	8,500	6,180	5,194	4,600	27
15,330	24,715	12,990	8,375	2,260	5,240	4,600	4,000
12,630	20,760	12,360	8,200	6,540	5,125	4,200	4,240
....	19,045	13,530	7,750	5,700	5,010	7	4,800
....	17,330	13,680	6,852	5,700	4,660	4,400	5,585
....	16,630	....	8,375	....	4,360	3,900	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the ye ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1909–10.												
1.	7,140	4,500	5,470	3,762	8,425	16,385	19,080	11,888	7,500	5,240	4,905	3,
2.	6,780	4,460	5,378	89	8,250	25,380	17,085	12,180	7,452	4,560	4,720	4,
3.	......	4,500	5,355	4,260	8,150	27,470	14,970	11,175	8,875	1,884	4,700	3,
4.	6,780	4,500	5,010	4,220	8,000	24,470	14,280	10,475	7,260	2,350	4,680	
5.	4,968	4,700	66	4,140	7,380	21,530	12,510	11,050	4,060	4,520	4,620	
6.	5,010	4,040	5,355	3,304	4,320	19,360	12,150	11,730	7,500	4,320	4,560	4,
7.	4,560	36	5,056	4,500	7,750	19,850	13,890	10,375	7,380	4,360	3,629	4,
8.	4,460	4,440	5,240	4,600	6,444	22,510	14,580	8,225	7,500	4,360	5,700	4,
9.	4,400	4,400	5,079	240	6,420	22,930	12,330	8,875	8,200	4,200	5,700	6,
10.	13	4,440	5,539	5,056	6,780	19,080	10,200	8,875	6,012	1,898	4,580	5,
11.	4,520	4,400	5,125	5,148	7,332	16,630	10,425	8,625	6,660	5,079	4,620	1,
12.	4,560	4,400	89	5,125	6,900	14,430	9,700	8,525	5,892	5,125	5,010	5,
13.	4,560	3,880	5,286	5,194	3,724	12,630	9,250	8,250	8,925	5,125	4,500	5,
14.	4,520	11	5,424	5,171	7,428	13,740	8,875	7,625	9,450	4,947	37	4,
15.	4,400	4,000	6,204	5,240	......	13,530	8,125	5,286	8,700	4,926	4,968	4,
16.	4,200	4,000	6,732	216	7,380	12,960	7,625	7,925	7,800	4,440	4,968	4,
17.	5	3,980	6,948	5,631	7,140	12,330	5,240	7,750	7,380	55	4,800	4,
18.	4,200	4,000	6,612	5,470	7,188	11,430	7,700	7,700	6,900	4,640	4,760	
19.	4,120	4,040	255	5,470	7,140	10,425	5,940	7,675	6,492	4,560	6,252	4,
20.	4,100	3,466	6,252	5,772	4,040	8,825	9,800	7,700	8,500	4,560	8,000	4,
21.	4,100	25	5,447	5,608	7,625	11,050	12,240	7,625	7,875	4,500	35	4,
22.	4,080	4,000	5,355	6,228	7,975	11,888	11,670	5,378	7,212	4,500	5,516	4,
23.	3,920	4,000	5,240	11,300	8,075	12,540	10,925	8,000	7,164	4,160	5,194	4,
24.	34	4,100	5,240	20,970	8,125	12,720	12,780	7,750	6,540	61	5,010	4,
25.	4,320	70	95	16,175	8,275	13,680	12,330	7,675	5,401	4,700	5,010	
26.	4,600	4,600	270	13,080	7,825	16,875	10,925	7,575	3,034	4,560	5,010	4,
27.	4,600	4,560	5,355	11,250	5,820	21,530	13,140	7,380	7,092	4,540	2,805	4,
28.	4,600	2,335	4,600	9,675	9,450	19,080	21,005	7,260	7,020	4,580	13	4,
29.	4,500	6,372	4,660	8,875	......	16,805	17,855	4,440	6,876	......	4,120	4,
30.	4,360	6,420	4,600	7,750	......	16,000	14,100	4,020	5,516	......	3,705	4,
31.	......	......	4,080	8,975	......	19,080	......	7,625	......	630	3,592	....
1910–11.												
1.	4,140	3,088	4,905	888	6,300	5,820	16,875	15,510	6,972	4,863	5,240	6,
2.	8	3,070	4,905	5,470	6,036	6,228	11,640	15,180	6,492	25	5,240	4,
3.	4,140	3,430	4,600	5,470	5,125	6,060	10,750	15,510	4,640	1,856	5,125	2,
4.	4,140	3,900	42	6,588	4,800	5,585	9,575	13,530	2,618	83	5,056	1,
5.	4,060	4,000	4,700	7,575	338	805	9,200	10,750	5,608	4,460	4,842	6,
6.	4,100	3,430	4,200	8,000	5,748	5,724	9,400	9,400	6,132	4,200	32	5,
7.	4,100	5,820	4,160	7,140	5,940	5,378	13,980	6,660	6,228	2,380	4,120	5,
8.	3,743	6,108	4,140	4,080	5,724	5,332	18,905	9,075	6,252	3,160	4,200	4,
9.	15	5,988	4,100	7,188	5,286	5,171	19,360	8,775	6,228	721	4,140	4,
10.	3,960	5,940	3,960	6,900	5,286	5,171	18,205	8,850	6,588	5,424	4,040	
11.	3,900	5,844	83	6,420	4,640	4,660	15,480	8,750	2,499	5,171	4,000	4,
12.	3,800	5,844	3,705	6,228	210	195	14,280	8,500	6,300	4,700	3,520	4,
13.	4,000	77	2,980	6,540	4,760	5,309	13,380	7,875	6,228	4,120	10	5,
14.	3,840	5,355	2,890	6,180	4,800	5,309	13,530	5,585	6,276	3,268	3,070	5,
15.	3,743	5,355	2,890	440	4,800	6,420	15,420	8,450	7,140	3,250	3,016	5,
16.	13	5,194	2,980	6,180	4,760	11,888	19,955	8,375	7,875	15	3,016	4,
17.	4,000	5,125	2,686	5,585	4,700	8,750	20,935	8,125	7,140	3,394	3,430	
18.	4,020	4,600	76	5,424	4,400	7,452	16,630	7,305	3,484	2,230	3,610	5,
19.	3,705	4,340	2,980	5,309	198	4,440	13,290	7,525	7,260	2,230	3,466	5,
20.	3,705	30	2,980	4,680	4,905	7,750	12,570	7,332	7,188	2,335	15	5,
21.	3,705	4,600	2,926	4,340	4,821	7,700	12,930	3,106	5,309	2,380	4,140	5,
22.	3,358	4,500	2,980	115	4,760	7,650	12,330	7,332	5,309	2,380	4,060	4,
23.	34	4,460	2,944	4,821	4,740	7,775	10,875	7,044	5,892	17	2,944	4,
24.	3,667	204	2,926	4,700	4,760	7,800	11,375	6,924	5,700	3,610	2,980	
25.	2,771	4,340	127	4,600	4,400	......	10,800	6,852	55	3,340	3,016	5,
26.	2,771	4,500	5,240	4,660	189	3,724	11,888	6,972	5,700	3,610	3,070	4,
27.	3,705	39	4,500	4,640	4,947	8,250	12,690	6,228	5,286	3,574	51	4,
28.	3,800	4,500	4,520	4,440	5,700	11,580	13,890	3,686	5,240	3,781	3,106	4,
29.	3,574	4,500	4,460	1,940	......	15,480	14,430	3,960	5,194	3,520	3,900	5,
30.	29	4,500	5,940	5,700	......	17,085	14,580	2,771	4,740	33	4,100	4,
31.	3,781	......	6,012	6,948	......	21,705	......	7,188	......	4,600	4,300	....

of Merrimack River of Lowell, Mass., for the years 848–1861; 1866-1915—Continued.

		n.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
		175	6,972	8,000	23,280	11,200	15,030	6,132	5,355	29
		825	6,732	7,750	22,755	10,925	14,070	5,916	5,286	30
		375	6,732	2,890	22,685	10,600	13,320	5,748	5,240	5,585
		250	2,771	7,775	20,900	9,900	12,930	162	30	5,401
		,250	6,660	6,660	17,995	7,140	12,240	5,772	5,772	5,585
		,925	6,420	6,540	16,665	10,150	10,975	5,401	5,820	6,108
		,880	6,396	6,420	18,940	10,150	10,300	46	5,700	7,380
		,625	6,372	6,420	24,330	11,125	9,125	4,660	5,940	29
		,625	6,396	7,500	29,910	11,125	6,804	4,600	6,108	6,372
		,420	6,684	3,430	24,855	11,580	9,475	4,500	5,988	6,252
		,612	1,314	7,700	20,305	10,925	7,625	4,700	36	6,132
		7,308	6,348	7,700	17,400	8,375	8,550	4,500	5,539	5,010
		6,948	6,108	9,000	16,105	10,800	8,550	4,300	7,500	5,010
		3,610	6,012	12,480	14,490	10,925	8,325	72	7,500	4,800
		6,852	5,585	15,030	15,330	12,060	7,700	4,884	7,284	30
		6,468	5,724	18,065	14,880	11,175	3,430	5,010	7,260	5,286
		6,732	6,468	23,665	16,105	11,300	7,875	4,905	7,020	5,988
		6,780	234	21,680	21,355	13,980	7,675	4,440	66	5,892
		6,948	5,940	23,105	21,705	13,710	6,732	4,560	6,492	5,748
		7,380	5,916	23,630	21,355	12,630	6,732	4,400	5,988	7,092
		4,240	6,084	23,560	18,905	11,350	7,452	31	6,060	7,332
		7,308	....	20,270	17,505	11,430	7,380	4,720	5,309	38
		7,750	7,825	16,805	16,385	13,530	....	5,631	5,332	6,972
		7,625	7,975	14,610	18,555	13,020	6,612	5,585	5,868	6,732
	0	8,075	4,600	12,630	18,100	12,330	6,492	6,012	60	6,660
	0	8,000	8,800	11,460	14,580	10,375	6,420	6,060	5,892	6,492
	0	7,260	8,625	10,875	13,380	10,925	5,940	5,772	5,079	6,396
	5	3,394	8,625	10,475	11,580	10,425	5,378	35	5,125	6,372
	5	7,625	8,150	12,270	13,470	9,900	4,968	5,424	5,079	27
	25	7,356	....	22,930	12,240	7,020	59	5,355	5,079	6,060
	50	6,900	....	24,960	....	11,460	....	5,378	4,760	....
	40	10,475	8,625	8,425	19,010	10,925	11,730	5,194	3,920	833
	25	11,225	6,204	6,540	23,350	10,025	11,490	5,010	3,743	4,926
	925	10,750	9,075	8,675	18,030	....	10,025	5,010	50	4,600
	950	11,888	8,450	8,675	15,030	6,636	9,325	112	3,900	4,560
	150	11,730	8,500	8,950	13,680	9,250	8,825	306	4,140	4,520
	675	12,490	8,375	8,525	13,380	8,950	8,750	1,748	4,000	4,500
	500	10,725	8,200	8,325	14,220	8,875	8,125	5,240	4,140	40
	075	10,225	8,000	7,825	13,100	8,800	4,800	4,905	4,340	4,060
	,250	8,325	4,040	3,592	11,888	8,750	8,575	4,700	4,240	4,100
	,425	8,325	7,875	8,300	11,050	8,425	7,775	4,700	47	3,820
	,275	8,375	7,625	86	10,675	4,400	7,550	4,926	4,300	3,860
	,175	6,564	6,372	9,400	11,200	8,650	7,550	4,700	3,800	3,940
	,925	8,975	6,828	9,900	12,930	8,200	7,500	25	3,800	3,648
	7,500	8,800	7,188	10,225	15,480	8,125	7,308	5,010	3,840	32
	3,340	9,075	7,236	14,790	15,750	7,500	2,095	5,010	3,800	3,430
	7,775	8,850	2,962	19,920	15,120	7,675	6,660	4,905	3,610	3,196
	7,625	8,825	7,308	24,365	14,310	7,800	6,588	4,905	29	3,232
	7,600	8,750	7,020	19,045	13,110	3,430	6,180	4,905	3,686	3,196
	7,750	7,800	7,020	14,290	10,925	7,575	6,132	4,700	3,743	3,250
	8,125	10,875	6,660	12,270	9,800	6,612	5,700	33	3,743	3,250
	8,625	11,125	6,708	14,370	11,460	6,852	6,420	4,842	3,629	41
	5,447	10,650	4,821	20,795	10,675	6,900	97	4,300	3,610	3,610
	8,375	10,475	4,947	26,510	10,150	7,380	6,900	4,300	3,430	3,762
	8,000	9,900	8,500	18,555	9,850	7,825	5,892	3,900	24	5,056
	2,155	9,700	8,650	14,730	9,900	10,200	5,470	3,900	3,016	8,125
	7,625	7,925	8,375	16,945	9,300	13,080	5,401	3,800	2,980	7,284
	7,675	9,400	8,200	29,830	8,000	11,790	5,240	52	2,926	6,252
0	6,900	9,000	8,150	33,150	10,025	10,300	5,654	3,800	2,926	47
0	4,420	8,500	....	39,542	10,075	10,350	61	3,743	3,340	5,355
5	8,375	8,425	....	26,255	10,800	14,940	5,355	3,781	240	4,780
.	9,000	8,575	....	20,830	....	15,780	....	3,940	47	....

Ten-hour discharge, in second-feet, of Merrimack River at Lowell, Mass., for the year ending Sept. 30, 1848–1861; 1866–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	4,640	7,875	8,275	7,452	7,875	3,520	20,305	25,485	8,300	5,654	4,760	6,06
2	4,000	4,300	7,750	7,332	9,900	13,440	21,530	21,915	7,875	6,540	15	5,98
3	5,424	8,350	7,675	7,260	9,650	25,135	29,230	17,365	7,020	6,900	5,056	5,47
4	5,868	7,550	7,750	2,380	9,400	30,630	26,630	16,105	7,044	138	4,863	5,19
5	2,980	7,380	7,825	7,140	9,525	29,270	20,900	15,690	7,452	2,737	5,056	4,24
6	6,060	7,044	8,000	7,140	9,400	24,435	18,275	17,435	7,476	5,470	5,010	1,96
7	5,631	6,948	3,940	6,732	8,750	19,780	15,870	19,360	5,539	5,148	5,010	1,63
8	5,470	7,188	8,325	7,140	5,309	16,630	15,120	18,695	7,625	5,844	4,660	5,47
9	5,355	630	9,850	7,020	8,800	14,790	16,805	15,930	8,150	5,654	19	5,28
10	5,631	7,800	9,850	7,140	8,425	12,990	23,630	15,150	7,575	5,539	4,760	5,28
11	6,420	13,860	9,075	2,170	8,000	11,175	23,175	16,035	7,625	5,470	4,560	5,12
12	50	11,610	8,625	7,260	7,825	10,625	19,255	14,370	7,260	2,305	4,620	4,90
13	255	9,325	8,700	6,444	7,428	10,200	18,835	14,010	7,068	6,276	4,540	9
14	5,654	8,625	4,700	6,420	7,625	9,950	18,205	15,480	1,605	7,140	4,760	5,07
15	5,516	9,850	8,425	6,156	3,016	8,125	16,140	15,630	7,625	7,428	4,700	4,80
16	6,324	4,420	8,175	5,585	7,260	9,775	15,000	13,920	5,940	5,988	38	4,80
17	6,036	8,375	8,000	6,180	6,852	10,725	15,720	11,300	6,300	5,194	5,010	4,80
18	6,660	8,150	8,025	267	6,828	11,225	15,570	11,820	6,252	5,286	5,056	4,40
19	72	7,140	8,250	6,372	6,828	11,850	15,360	11,050	6,252	38	4,947	4,30
20	5,309	7,332	7,875	5,470	6,780	11,175	16,840	10,675	6,540	5,964	4,947	4
21	6,804	7,625	2,771	5,539	6,780	10,025	26,630	10,225	298	5,892	5,010	4,40
22	8,175	8,175	7,750	5,940	3,340	7,428	36,030	10,025	6,900	5,820	4,968	4,28
23	8,675	4,340	7,825	6,420	3,106	10,075	27,390	9,325	5,820	5,240	38	4,24
24	8,075	8,100	7,875	6,780	7,675	9,775	20,410	7,044	5,585	5,240	5,700	4,20
25	7,188	7,775	2,669	1,605	6,540	9,775	16,350	9,450	5,585	5,010	5,964	4,20
26	4,968	7,625	8,125	7,380	6,372	9,850	13,830	8,925	5,539	17	5,988	4,00
27	10,025	1,842	8,000	7,500	6,252	11,580	18,555	8,800	6,540	5,010	5,493	1
28	10,150	7,212	3,520	8,425	6,972	17,680	26,185	8,625	47	5,010	5,355	3,64
29	9,650	7,140	8,075	9,000	....	25,870	26,010	8,150	5,772	4,968	5,056	3,68
30	9,050	3,160	7,550	9,125	....	25,450	25,170	4,200	5,654	4,968	112	3,62
31	8,600	....	7,500	9,050	....	22,510	....	4,100	....	4,905	5,585	......
1914–15.												
1	3,667	17	4,842	4,040	7,625	17,680	7,750	7,750	6,348	5,194	6,108	7,02
2	3,648	3,705	4,863	4,040	7,332	13,620	7,675	11,300	6,420	5,700	8,425	6,82
3	3,574	3,667	5,056	130	7,140	12,030	7,092	11,175	6,300	6,612	8,250	6,61
4	19	3,743	5,585	3,743	6,492	8,825	4,140	10,100	5,355	12,480	8,925	6,30
5	3,556	3,724	6,108	3,705	6,540	9,975	7,950	9,250	5,240	11,970	17,855	3,46
6	3,610	3,705	1,423	3,667	7,140	9,700	7,975	8,625	52	10,750	23,805	3,03
7	3,610	3,592	5,585	4,400	2,550	7,284	8,100	8,175	5,516	9,850	21,040	7,14
8	3,610	16	5,424	6,708	8,075	9,725	8,250	7,625	5,470	8,375	16,980	7,02
9	3,610	3,705	5,286	7,452	8,050	9,000	8,150	5,240	5,516	15,030	15,570	6,06
10	3,466	3,610	5,309	4,640	8,125	8,925	8,875	8,300	4,660	32,510	15,360	5,98
11	11	3,574	5,240	7,188	7,975	8,875	8,675	8,075	4,700	24,505	14,460	5,65
12	74	3,574	4,800	7,500	7,750	8,875	13,470	8,000	4,540	18,275	11,580	1,00
13	3,556	3,556	100	7,675	7,700	8,000	21,320	7,825	38	14,820	10,850	6,01
14	3,610	3,466	4,905	7,700	3,430	5,125	18,275	7,750	4,660	11,350	10,925	6,06
15	3,610	29	6,252	7,675	7,850	8,825	13,980	7,188	4,800	9,650	9,400	6,03
16	3,520	3,705	4,800	7,332	8,250	8,375	11,580	3,724	4,780	8,625	9,900	5,94
17	3,484	3,705	4,968	2,635	8,975	8,100	10,150	8,000	4,380	7,380	12,240	5,98
18	23	3,667	4,968	8,050	9,450	7,700	8,375	7,750	4,340	5,964	9,650	5,35
19	3,762	4,800	4,905	9,150	9,325	7,500	8,000	7,068	4,300	7,308	9,000	6
20	3,648	5,772	142	13,080	8,325	6,852	9,125	6,780	1,856	6,252	8,200	5,65
21	3,705	5,700	4,000	14,520	6,012	3,840	8,875	6,900	4,968	5,892	7,500	5,44
22	3,705	225	4,360	11,430	5,820	7,925	8,650	6,852	5,355	5,820	4,640	5,58
23	3,724	5,700	4,300	8,950	8,275	7,700	8,325	2,980	5,240	5,700	7,875	5,82
24	3,520	6,060	4,240	6,660	8,125	7,750	7,875	6,900	5,148	5,309	10,725	7,26
25	16	5,940	116	8,675	10,575	7,750	4,680	6,660	5,125	4,220	12,090	6,90
26	3,705	165	2,635	8,275	28,350	7,800	8,500	6,684	5,585	6,060	9,575	2,55
27	3,629	3,556	132	8,375	37,060	7,700	8,450	6,540	50	5,988	9,525	7,26
28	3,648	3,574	4,200	8,075	23,105	5,263	8,625	6,420	5,286	9,175	8,875	6,06
29	3,705	246	4,160	7,800	....	7,875	8,175	5,892	4,800	8,000	5,424	6,13
30	3,705	5,010	4,060	7,380	....	7,875	7,950	2,305	4,800	8,375	7,800	6,06
31	3,556	....	4,040	3,160	....	7,775	....	2,095	....	8,325	6,972	......

Note.—Discharge determined from six rating curves applicable as follows: 1848 to 1887, 1888 to 1892, 189 to 1896, 1897 to 1898, 1899 to 1907, and 1908 to 1915. The curve for the period 1908 to 1915 was determine from the discharge of the river at various gage heights; other curves were derived from this curve by makin corrections for differences of elevation of river bed at Hunts Falls a short distance below the gage. These curves have been checked at several points by records of the quantity of water used by the mills. Figure presented in the table show 10-hour flow only, no figures being given for Sundays or holidays previous t 1903 when the mills were not in operation, and those given for later years have not been used in the computations of monthly discharge.

ver at Lowell, Mass., for the years ending Sept. 30,
8–1861; 1866–1915.

ond-feet rs.		
		Mean.
		8,410
	0	6,343
	0	8,910
	0	9,758
	0	11,971
	0	6,943
	0	5,022
	0	4,876
	0	4,688
	00	6,595
	40	6,984
	50	8,087
	60	6,680
	60	5,345
	320	8,709
	600	10,371
	700	8,102
	700	6,318
	240	4,474
	140	6,132
	,120	4,530
	,120	6,860
	,480	6,991
	,500	11,782
	5,910	6,599
	5,600	6,630
	6,125	9,644
	7,075	9,060
	8,075	13,817
	12,010	19,815
	6,650	9,876
	5,400	7,180
	4,900	6,814
	5,320	7,904
	4,480	9,680
	4,740	6,300
	5,060	5,924
	5,500	6,498
	5,280	5,672
	5,450	11,024
	7,550	9,[illegible]
	9,275	13,[illegible]
	5,650	8,953
	5,240	6,590
	3,590	5,298
	3,340	4,622
	3,790	4,205
	3,340	7,340
5	4,060	4,717
5	5,160	8,703
0	5,200	6,099
0	5,790	8,629
0	5,600	7,079
35	5,790	9,685
00	9,000	21,655
90	7,225	12,734
20	4,860	6,089
90	4,360	4,781
40	4,280	4,845
275	4,440	5,142
000	4,060	8,350

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	Minimum.	Mean.
1852–53.			
October	5,600	4,740	5,016
November	16,890	5,400	7,768
December	10,850	6,225	8,184
January	9,725	5,690	6,864
February	32,200	5,600	11,985
March	15,400	7,700	9,974
April	17,220	8,840	11,672
May	25,900	7,325	10,339
June	10,390	4,740	6,286
July	4,780	4,400	4,603
August	6,930	4,780	5,476
September	9,425	3,340	5,995
The year	32,200	3,340	7,850
1853–4.			
October	19,645	5,060	7,718
November	24,100	5,750	10,560
December	7,860	5,240	6,077
January	10,625	5,400	6,855
February	7,500	5,710	6,226
March	21,220	7,325	10,493
April	26,400	7,175	13,415
May	38,800	8,275	16,884
June	8,420	5,240	6,334
July	5,320	4,520	4,874
August	4,780	4,440	4,612
September	5,950	4,400	4,932
The year	38,800	4,400	8,250
1854–55.			
October	5,400	4,660	4,942
November	19,645	4,860	8,322
December	9,325	5,830	6,847
January	17,400	5,650	8,670
February	17,750	6,750	10,220
March	9,050	6,600	7,118
April	33,600	10,050	18,294
May	14,350	5,750	8,997
June	13,200	5,650	8,092
July	7,325	5,060	6,013
August	6,420	4,980	5,456
September	5,400	4,940	5,040
The year	33,600	4,660	8,170
1855–56.			
October	22,900	5,060	10,088
November	10,730	6,600	7,795
December	11,620	5,950	7,348
January	7,500	6,075	6,662
February	6,930	5,060	6,246
March	6,340	4,900	5,475
April	21,965	5,600	12,839
May	14,800	7,400	9,263
June	7.740	5,280	6,367
July	5,400	4,400	4,940
August	17,995	4,480	8,826
September	9,325	5,650	6,438
The year	22,900	4,400	7,690
1856–57.			
October	11,450	5,790	6,576
November	6,300	5,500	5,915
December	8,275	5,710	6,659
January	8,780	5,870	7,464
February	22,700	6,700	12,391
March	14,860	6,175	8,509
April	26,900	8,025	14,671
May	30,100	9,900	14,544
June	10,270	5,790	7,983
July	8,600	5,200	6,001

Monthly discharge of Merrimack River at Lowell, Mass., for the years ending Sept.
1848–1861; 1866–1915—Continued.

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	Minimum.	Mean.
1856–57—contd.			
August	11,450	5,400	7,149
September	9,100	4,560	5,507
The year	30,100	4,560	8,610
1857–58.			
October	24,900	4,060	7,605
November	10,000	6,340	8,099
December	11,740	5,790	8,034
January	13,470	6,125	8,666
February	8,460	4,980	6,235
March	15,100	4,900	7,516
April	11,300	7,600	8,641
May	11,860	7,700	9,091
June	10,625	5,710	7,027
July	6,420	5,140	5,486
August	6,340	5,140	5,495
September	24,300	5,200	6,939
The year	24,900	4,060	7,400
1858–59.			
October	8,900	5,400	6,361
November	10,625	5,600	7,150
December	7,975	5,400	5,997
January	10,625	5,550	7,157
February	7,900	6,300	6,819
March	42,400	6,300	16,997
April	23,650	10.625	14,092
May	13,925	6,810	10,611
June	11.250	5,950	7,611
July	8,125	5,060	5.815
August	5,710	4,900	5,024
September	7,500	4,820	5,209
The year	42,400	4,820	8,240
1859–60.			
October	5,500	4,980	5,149
November	9,275	4,560	5,800
December	8,560	5,950	6,929
January	8,420	5,600	6,571
February	10,760	5,425	6,666
March	16,325	7,100	9,541
April	8.660	5,690	7,144
May	6,400	5,040	5,487
June	6,830	5,060	5,725
July	5,790	5,000	5,208
August	7,150	4,960	5,590
September	9,525	4,960	6,649
The year	16,325	4,560	6,370
1860–61.			
October	7,125	5,970	6,348
November	15,460	6,030	9,174
December	10,525	6,225	7,451
January	8,075	6,300	6,809
February	16,130	6,400	9,444
March	21,000	8,000	13,969
April	30,000	12,410	16,904
May	20,220	7,820	11.773
1866.			
March	11.375	5,690	7,613
April	14.225	7,700	9,895
May	11.375	5,710	6,667
June	12,225	5,120	6.992
July	6,500	4,360	5,070
August	6,175	4,820	5,272
September	8,400	4,540	5,714

Month.	Discharge in second- for 10 hours.		
	Maximum.	Minimum.	Me
1866–67.			
October	9,150	4,820	5,
November	16,860	5,600	8,
December	9,350	5,525	7,
January	9.100	5,710	6.
February	16,400	5,950	9,
March	7,820	5,750	6,
April	27,000	7,925	14,
May	17,160	8,600	11,
June	13.110	5,750	7,
July	5,950	4,720	5,
August	19,575	5.000	8,
September	6.890	4,800	5,
The year	27,000	4,720	7,
1867–68.			
October	7,400	4,880	5,
November	8,400	5,060	6,
December	7,600	5,320	6,
January	7,050	5,280	5,
February	6,300	5,280	5,
March	20,900	5,060	10,
April	18,030	7,950	10,
May	30,000	7,840	14,
June	14,065	6,300	9,2
July	5,670	4,700	5,
August	5,525	4,740	5,
September	17,925	4,760	8,
The year	30,000	4,700	7,6
1868–69.			
October	9.150	5,690	6,3
November	14,500	7,125	9,4
December	8,900	5,575	6,6
January	7,700	5,340	6,3
February	7,475	5,400	6,2
March	22,950	5,525	8,1
April	33.600	15,100	20,6
May	15.130	8,460	11,5
June	8,275	5,670	6,5
July	7,450	4,760	5,5
August	5,080	4,540	4,8
September	7,250	4,460	4,9
The year	33,600	4,460	8,1
1869–70.			
October	45,900	5,200	14,1
November	14,410	5,550	7,4
December	17,190	5,600	8,7
January	34,400	9,325	13,2
February	29,000	7,100	10,0
March	18,250	6,400	8,6
April	58,400	16,890	26,1
May	13,200	6,525	9,5
June	6.250	5,240	5,6
July	7,050	4,660	5,1
August	4,860	4,360	4,6
September	4,960	3.940	4.5
The year	58,400	3.940	9,8
1870–71.			
October	5.140	4,300	4,6
November	6,225	4,660	5,1
December	6,950	4,700	5.3
January	6,400	4,600	5.2
February	11,250	4,600	5,8
March	22,900	7,050	10,0
April	9,950	7,100	8,1
May	21,545	5,550	9,4

iver at Lowell, Mass., for the years ending Sept. 30, 1; 1866–1915—Continued.

econd-feet urs.		
		Mean.
	0	5,517
	30	4,723
	00	4,785
	20	4,797
	00	6,140
	900	5,506
	360	7,712
	840	6.371
	020	6.192
	880	5,210
	820	5,292
	710	13.562
	440	8,169
	790	8,684
	980	5,525
	,929	7.389
	,970	7.759
	,300	7,280
	,175	7,745
	,375	9,604
	,890	7,050
	,275	7,911
	,100	6,792
	5,930	6,474
	2,960	18,763
	8,250	11,985
	4,800	5,763
	4,800	5,095
	4,900	5,128
	4,800	5,253
	4,800	8,130
	4,960	9,218
	5,870	6,695
	5,770	7,647
	5,890	11,191
	6,500	8,261
	6,625	8,752
	6,400	9,166
	11,530	13,598
	6,320	9,047
	5,600	8,911
	5,220	5,779
	4,520	5,031
	4,520	8,610
	4,960	5,284
	4,860	5,090
	4,560	5,230
	4,640	5,242
	5,200	5.848
5	5,475	6,700
0	7,475	14,947
0	7,700	10,100
5	4,900	6,558
0	4,920	5,174
5	5,020	5,526
0	4,960	5,163
00	4,560	6,740

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	**Minimum.**	**Mean.**
1875–76.			
October	6,275	5,140	5,438
November	12,350	5,850	7,923
December	7,780	5,340	6,103
January	10.075	5,575	6,746
February	8.025	5,625	6,672
March	31.750	5,500	13,758
April	29,000	12,775	16,573
May	23,200	8,400	12,848
June	11,300	5,500	7,031
July	6,175	4,900	5,287
August	5,910	4,740	5,206
September	5,380	4,400	4,957
The year	31,750	4,400	8,220
1876–77.			
October	5.450	4,740	5,117
November	6,700	4,800	5,622
December	5,650	4,840	5,218
January	5.850	5,280	5,531
February	5,670	5,080	5,287
March	41,500	5,120	12,573
April	16,730	9,225	12,369
May	11,325	6,050	7,700
June	6,380	5,020	5,615
July	7,425	5,140	5,676
August	11,500	5,000	6,261
September	6,050	4,780	5,238
The year	41,500	4,740	6,850
1877–78.			
October	8,900	4,600	6,731
November	17,855	6,320	10,118
December	13,500	6,050	8,313
January	9,475	5,475	7,312
February	10,210	6,030	7,405
March	16,920	5,930	12,052
April	30,100	9,575	12,975
May	32,700	5,830	11,391
June	10,300	5,320	6,706
July	6,125	5,000	5,342
August	9,100	5,340	6,047
September	5,730	4,760	5,309
The year	32,700	4,600	8,310
1878–79.			
October	8,100	4,520	5,162
November	14,440	4,900	7,257
December	49,600	7,450	14,560
January	7,375	5,575	6,211
February	14,500	5,400	7,438
March	11,800	6,600	7,922
April	21,965	8,075	14,343
May	24,600	6,075	11,577
June	10,940	5,650	7,113
July	7,400	4,960	5,588
August	10,850	4,880	5,040
September	7,400	4,840	5,365
The year	49,600	4,520	8,130
1879–80.			
October	5,240	4,860	4,974
November	8,520	4,800	5,772
December	12,825	5,300	7,150
January	13,925	5,240	6,944
February	13,675	6,075	9,258
March	13,020	6,340	8,652
April	18,190	6,675	9,007

Monthly discharge of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—Continued.

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	Minimum.	Mean.
1879–80—contd.			
May	8,950	5,060	6,318
June	5,830	4,520	5,090
July	5,650	4,700	5,032
August	5,060	4,560	4,777
September	5,040	4,200	4,501
The year	18,190	4,200	6,460
1880–81.			
October	4,480	3,970	4,168
November	10,025	4,820	5,857
December	5,180	4,400	4,762
January	5,750	4,080	4,718
February	9,275	4,640	6,136
March	16,800	6,420	11,001
April	15,040	7,575	11,081
May	17,820	6,810	10,396
June	7,700	5,200	5,912
July	7,880	4,700	5,413
August	5,930	4,560	4,940
September	5,200	4,440	4,873
The year	17,820	3,970	6,600
1881–82.			
October	5,400	4,440	4,746
November	7,950	5,080	6,226
December	18,610	5,200	7,784
January	12,300	5,425	7,182
February	12,410	5,360	7,791
March	21,930	7,325	11,324
April	10,880	6,910	8,805
May	16,130	6,010	8,718
June	14,980	5,100	8,518
July	6,225	4,780	5,092
August	4,940	4,320	4,694
September	12,380	4,100	5,373
The year	21,930	4,100	7,190
1882–83.			
October	5,380	4,760	4,976
November	5,000	4,240	4,467
December	4,500	4,160	4,330
January	4,680	4,040	4,321
February	6,750	4,160	4,770
March	6,850	4,940	5,715
April	23,100	6,500	12,433
May	12,500	6,525	8,112
June	13,380	4,920	6,114
July	6,625	4,620	5,037
August	4,900	3,910	,443
September	4,960	3,270	3,670
The year	23,100	3,270	5,700
1883–84.			
October	5,770	3,545	4,346
November	6,320	4,380	4,944
December	4,980	4,000	4,587
January	7,000	4,840	5,390
February	12,200	5,040	7,723
March	33,800	5,425	11,402
April	30,800	12,100	16,742
May	12,150	7,975	9,160
June	6,500	4,660	5,325
July	4,920	4,340	4,706
August	6,810	4,500	4,776
September	4,880	3,320	4,081
The year	33,800	3,320	6,930

Month.	Discharge in second-fe for 10 hours.		
	Maximum.	Minimum.	Mean
1884–85.			
October	4,340	4,080	4,16
November	5,575	3,970	4,48
December	8,150	4,520	5,35
January	12,440	5,160	7,24
February	6,910	4,860	5,64
March	6,500	4,800	5,26
April	15,760	6,790	12,34
May	12,325	5,120	7,67
June	8,175	4,480	5,43
July	5,340	4,300	4,72
August	14,350	4,640	5,85
September	5,870	4,500	4,81
The year	15,760	3,970	6,08
1885–86.			
October	7,175	4,400	4,96
November	15,730	5,625	8,11
December	10,050	4,800	6,44
January	26,450	5,360	8,81
February	31,600	5,650	11,47
March	12,775	6,050	7,72
April	29,400	7,600	14,59
May	8,500	5,280	6,82
June	5,160	4,480	4,75
July	4,840	4,440	4,55
August	4,640	4,200	4,49
September	4,660	4,240	4,47
The year	31,600	4,200	7,27
1886–87.			
October	6,380	3,985	4,43
November	13,750	4,360	6,34
December	8,100	4,640	5,66
January	17,750	4,580	6,77
February	17,040	6,625	8,67
March	9,850	5,600	7,16
April	30,100	8,075	16,35
May	20,780	5,475	10,49
June	18,640	4,340	7,05
July	15,790	4,280	6,69
August	14,800	4,640	7,41
September	6,500	4,320	5,00
The year	30,100	3,985	7,67
1887–88.			
October	5,340	3,420	4,46
November	8,275	4,200	5,25
December	10,760	3,530	5,96
January	9,350	5,330	6,82
February	11,875	5,210	6,93
March	21,400	5,850	9,71
April	25,300	15,150	18,05
May	30,250	9,400	16,77
June	10,250	5,170	6,67
July	9,375	4,650	5,24
August	5,330	4,930	5,06
September	16,100	4,790	7,75
The year	30,250	3,420	8,23
1888–89.			
October	15,250	8,775	10,67
November	20,500	8,275	11,10
December	25,800	7,140	12,32
January	17,000	7,800	10,19
February	8,000	5,310	6,92
March	16,400	5,250	9.72
April	13,500	5,330	9,51
May	11,040	5,510	7,25

imack River at Lowell, Mass., for the years ending Sept. 30, 848-1861; 1866-1915—Continued.

arge in second-feet for 10 hours.		
- .	Mini-mum.	Mean.
5	4,850	6,569
0	4,810	5,465
0	4,850	6,093
0	4,750	5,758
0	4,750	8,470
5	5,270	7,011
0	6,080	8,825
0	6,375	10,963
0	6,325	7,823
0	6,160	8,710
0	6,590	12,010
0	10,580	13,736
0	7,740	11,935
0	5,290	7,559
0	4,810	5,191
0	4,310	5,151
0	5,190	8,054
0	4,310	8,910
0	6,000	10,470
25	6,750	8,495
0	5,250	5,735
0	5,370	8,818
0	7,540	10,909
0	9,600	17,900
0	9,900	16,560
0	5,350	7,434
0	4,750	5,698
00	4,690	4,871
00	4,350	4,710
50	4,175	4,501
00	4,175	8,840
30	3,980	4,214
50	3,850	4,340
50	4,350	5,449
00	5,410	9,070
60	4,850	5,386
00	4,750	6,737
00	5,010	7,558
50	5,050	9,236
00	4,490	6,320
90	4,350	5,830
00	4,310	5,545
25	4,235	5,150
50	3,850	6,240
90	3,650	4,149
00	4,060	6,544
50	3,650	4,514
60	4,990	6,184
50	5,300	7,299
50	6,050	10,839
00	11,340	14,940
00	9,075	18,129
75	6,130	7,172
50	5,010	5,676
50	4,100	5,395
25	4,610	5,851
00	3,650	8,060

Month.	Discharge in second-feet for 10 hours.		
	Maxi-mum.	Mini-mum.	Mean.
1893-94.			
October	11,400	4,950	6,773
November	8,400	6,090	6,786
December	9,550	5,925	7,529
January	8,000	6,275	7,061
February	8,250	5,900	6,781
March	20,400	6,200	12,341
April	17,100	9,100	11,007
May	15,270	6,350	8,504
June	12,890	5,825	8,038
July	7,050	5,440	6,141
August	5,750	4,390	5,152
September	7,925	4,490	5,740
The year	20,400	4,390	7,650
1894-95.			
October	6,990	4,850	5,864
November	8,040	5,990	6,907
December	7,400	5,700	6,667
January	6,890	5,500	6,257
February	6,725	5,500	5,847
March	10,675	5,300	7,569
April	66,700	8,450	18,943
May	10,350	6,500	8,222
June	7,340	5,600	6,225
July	7,075	4,890	6,337
August	6,890	4,890	6,082
September	6,350	4,690	5,498
The year	66,700	4,690	7,530
1895-96.			
October	12,950	4,810	7,401
November	16,700	7,050	10,668
December	16,500	7,750	10,481
January	20,550	7,050	8,943
February	23,200	7,100	10,082
March	73,400	8,870	18,918
April	26,000	9,750	16,372
May	9,325	6,050	7,379
June	8,080	5,460	6,726
July	7,925	4,810	5,439
August	5,380	4,040	4,948
September	7,800	3,940	6,280
The year	73,400	3,940	9,470
1896-97.			
October	10,500	4,750	6,717
November	18,200	5,850	7,538
December	8,040	4,190	6,108
January	10,450	7,000	7,425
February	12,300	7,150	8,819
March	19,200	7,000	12,344
April	24,100	12,950	18,048
May	26,200	9,200	12,352
June	35,900	8,650	14,185
July	41,100	8,500	14,292
August	11,250	8,550	10,190
September	9,950	6,100	7,156
The year	41,100	4,190	10,430
1897-98.			
October	7,400	4,850	5,971
November	12,100	5,050	8,358
December	33,600	7,500	11,915
January	10,600	6,800	8,190
February	10,400	7,350	8,607
March	33,000	8,450	17,452
April	27,500	10,400	14,992

Monthly discharge of Merrimack River at Lowell, Mass., for the years ending Sept. 30, 1848–1861; 1866–1915—Continued.

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	Minimum.	Mean.
1897–98—contd.			
May	15,700	8,050	11,172
June	10,900	6,750	8,315
July	7,100	4,550	5,438
August	7,600	4,400	5,437
September	6,750	3,700	4,946
The year	33,600	3,700	9,230
1898–99.			
October	12,350	4,600	7,085
November	18,000	5,200	8,960
December	15,200	6,450	8,415
January	13,050	8,500	10,379
February	9,500	7,100	8,213
March	19,500	9,050	13,306
April	38,800	14,950	26,696
May	25,100	7,300	12,229
June	7,300	5,900	6,523
July	7,050	5,800	6,629
August	6,900	5,150	5,817
September	6,450	4,400	5,348
The year	38,800	4,400	9,970
1899–1900.			
October	6,000	4,350	4,896
November	7,150	5,100	5,950
December	7,300	5,200	5,962
January	9,150	4,250	5,952
February	48,000	6,700	16,743
March	34,600	10,050	15,804
April	36,100	12,000	19,440
May	19,500	8,200	11,465
June	9,200	4,700	6,575
July	6,100	4,300	4,856
August	6,200	3,950	4,515
September	4,950	3,050	4,137
The year	48,000	3,050	8,860
1900–1901.			
October	6,750	4,400	5,341
November	15,700	4,550	7,576
December	17,200	5,000	8,542
January	7,200	5,450	6,141
February	6,300	4,700	5,137
March	25,600	4,700	10,650
April	66,400	11,800	26,076
May	28,700	9,350	15,502
June	18,600	5,700	9,235
July	6,750	3,400	5,667
August	12,050	5,650	6,972
September	6,700	4,650	5,796
The year	66,400	3,400	9,390
1901–2.			
October	13,450	4,850	6,702
November	7,000	5,300	6,267
December	37,700	5,500	11,531
January	22,700	6,650	10,802
February	11,950	6,300	7,600
March	55,600	13,900	24,681
April	36,400	10,000	16,644
May	24,800	7,100	11,144
June	8,700	5,850	7,432
July	7,650	5,700	6,834
August	9,550	5,350	6,660
September	8,200	5,100	6,470
The year	55,600	4,850	10,200
1902–3.			
October	25,800	7,200	9,670
November	12,700	7,000	8,160
December	21,000	6,550	9,621
January	11,500	7,550	8,991
February	14,150	8,500	10,211
March	42,400	14,700	26,692
April	24,300	7,150	15,144
May	7,300	3,050	5,238
June	34,800	4,900	12,119
July	9,550	5,900	7,296
August	7,250	5,400	6,369
September	6,550	4,800	5,446
The year	42,400	3,050	10,400
1903–4.			
October	8,250	4,800	6,402
November	7,350	1,600	6,071
December	9,750	5,150	6,371
January	6,700	5,250	5,731
February	6,900	5,350	5,781
March	31,700	6,200	11,863
April	44,600	12,100	19,492
May	34,000	9,050	16,080
June	9,050	5,200	6,944
July	6,900	4,100	5,472
August	7,800	4,500	5,481
September	9,200	4,350	5,502
The year	44,600	1,600	8,430
1904–5.			
October	7,900	5,300	6,367
November	6,400	4,900	5,642
December	5,900	3,700	4,508
January	8,250	4,900	6,337
February	6,100	4,650	5,043
March	40,600	4,550	12,052
April	40,500	8,250	15,083
May	8,350	5,450	7,148
June	9,050	5,050	6,400
July	7,100	4,600	5,470
August	7,150	4,600	5,517
September	20,500	6,550	9,768
The year	40,600	3,700	7,440
1905–6.			
October	6,700	5,550	6,148
November	7,400	5,500	6,384
December	15,300	6,500	7,890
January	24,700	6,950	9,107
February	10,450	6,300	7,413
March	17,600	6,000	9,039
April	35,400	9,400	16,321
May	38,400	6,900	11,027
June	20,700	7,400	11,519
July	10,450	6,300	7,532
August	10,800	5,050	6,244
September	6,100	4,250	4,729
The year	38,400	4,250	8,610
1906–7.			
October	6,750	4,300	5,180
November	7,650	4,550	6,338
December	7,150	4,800	5,860
January	9,750	6,550	7,841
February	7,100	5,400	6,248
March	17,900	5,250	8,575
April	25,400	8,250	13,006
May	17,200	7,250	9,971

iver at Lowell, Mass., for the years ending Sept. 30, 1; 1866–1915—Continued.

	econd-feet urs.	
	.	Mean.
	00	7,650
	50	6,204
	00	4,611
	50	5,960
	00	7,290
	450	9,959
	250	14,348
	750	10,462
	540	10,494
	940	9,734
	750	13,882
	550	14,186
	500	13,699
	,800	7,934
	,400	5,947
	,800	6,326
	,430	4,711
	,430	10,100
	3,376	4,026
	4,060	4,456
	4,500	4,876
	4,100	6,333
	5,355	8,890
	7,625	10,921
	12,360	19,245
	7,750	10,924
	5,700	7,472
	4,360	5,172
	3,900	4,502
	2,805	4,123
	2,805	7,580
	3,920	4,706
	3,466	4,408
	4,080	5,409
	3,304	7,035
	6,420	7,613
	10,425	16,845
	5,940	12,464
	7,260	8,696
	5,401	7,411
	4,160	5,485
	2,805	4,889
	3,250	4,561
	2,805	7,460
0	2,771	3,778
8	3,070	4,756
2	2,686	3,432
0	4,340	5,836
0	4,400	5,103
5	4,660	8,194
5	9,200	13,727
10	3,960	8,897
75	4,640	6,112
24	2,230	3,582

Month.	Discharge in second-feet for 10 hours.		
	Maximum.	Minimum.	Mean.
1910-11—contd.			
August	5,240	2,944	3,880
September	6,300	4,340	5,111
The year	21,705	2,230	6,030
1911-12.			
October	11,250	5,562	7,426
November	9,550	7,380	8,153
December	16,280	7,525	8,780
January	8,375	6,420	7,422
February	8,625	4,600	6,639
March	24,680	6,420	13,067
April	29,910	12,240	18,817
May	13,980	9,900	11,343
June	15,030	4,968	8,552
July	6,132	4,300	5,168
August	7,500	4,760	5,903
September	7,380	4,800	6,111
The year	29,910	4,300	8,950
1912-13.			
October	13,410	4,720	6,419
November	13,650	7,260	8,562
December	9,250	6,900	8,133
January	12,480	8,325	9,729
February	9,075	6,372	7,780
March	39,542	7,825	15,359
April	23,350	9,300	13,090
May	15,780	6,612	9,056
June	11,490	5,240	7,216
July	5,240	3,743	4,565
August	4,340	2,926	3,704
September	8,125	3,196	4,412
The year	39,542	2,926	8,170
1913-14.			
October	10,150	4,000	6,784
November	13,860	6,948	8,252
December	9,850	7,500	8,198
January	9,125	5,470	7,015
February	9,900	6,252	7,820
March	30,630	9,775	15,150
April	29,230	15,000	21,311
May	25,485	8,150	13,885
June	8,300	5,539	6,799
July	7,428	4,905	5,675
August	5,988	4,540	5,055
September	6,060	3,629	4,699
The year	30,630	3,629	9,220
1914-15.			
October	3,762	3,466	3,621
November	6,060	3,466	4,200
December	6,252	2,635	4,803
January	14,520	3,667	7,561
February	37,060	6,492	10,196
March	17,680	6,852	8,990
April	21,320	7,092	9,806
May	11,300	5,892	7,691
June	6,420	4,300	5,140
July	32,510	5,194	9,474
August	23,805	6,972	11,422
September	7,260	5,355	6,248
The year	37,060	2,635	7,430

MERRIMACK RIVER AT LAWRENCE, MASS.

Location.—At the dam of the Essex Co. in Lawrence.

Drainage area:

	Square miles
Total of Merrimack River basin above Lawrence	[1] 4,663
Net drainage area, excluding the diverted basins of Nashua and Sudbury rivers and Lake Cochituate	[1] 4,452

Records available.—January 1, 1880, to September 30, 1915.

Computations of discharge.—Accurate record is kept of the flow over the dam and through the various wheels and gates. This flow includes the water wasted into the Merrimack from the Nashua, Sudbury, and Cochituate drainage basins. Estimates of the quantity wasted from these basins are furnished by the Metropolitan Water and Sewerage Board of Boston and subtracted from the weekly and monthly quantities measured at Lawrence to obtain the net flow from the net drainage area of 4,452 square miles.

Extremes of discharge.—Maximum discharge for 24 hours recorded 1880–1915: 82,150 second-feet, March 3, 1896. A view of a flood stage at the Lawrence dam in August, 1914, is given in Plate X, *A* (p. 180).

Diversions.—Practically the entire flow of South Branch of Nashua River, Sudbury River, and Lake Cochituate is diverted for use by the metropolitan water district of Boston.

Regulation.—Flow regulated to some extent by storage in Lake Winnepesaukee. Low-water flow affected by operation of various power plants above Lawrence.

Storage.—There are several reservoirs in the basin. It is estimated that the water surface is about 3.5 per cent of the entire drainage area.

Accuracy.—Records are obtained with great care and are considered good. Those for the later years are probably more accurate than those for the earlier years.

Cooperation.—Entire record has been revised and furnished by R. A. Hale, principal assistant engineer of the Essex Co. The figures published herewith supersede all that have been presented in previous publications. The record was changed to the climatic-year form by engineers of the Geological Survey.

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[1] See footnote to tables of weekly discharge.

errimack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	5,240	20,600	17,840	6,080	8,280	3,100	2,690	1,430	2,690
	5,330	20,600	19,830	6,360	14,000	4,020	2,570	3,240	2,610
	5,470	15,310	18,220	6,940	10,920	4,460	2,610	2,760	2,450
	4,490	11,560	15,350	8,920	8,800	4,210	1,260	2,860	2,450
	5,370	9,910	15,500	19,300	8,040	3,800	2,890	2,840	55
	5,350	9,240	18,430	27,690	8,460	2,710	4,650	2,720	2,630
	5,500	9,110	19,460	27,620	8,120	3,880	3,550	3,200	2,580
	5,700	7,810	19,110	18,830	7,560	3,550	3,070	1,990	2,610
	5,370	8,750	15,460	15,000	6,310	3,590	2,760	3,380	2,420
	5,030	7,560	12,220	12,220	6,300	3,780	2,740	2,860	2,480
0	4,520	6,480	10,820	10,260	5,090	3,810	1,000	2,860	2,450
0	5,200	5,710	9,410	9,300	5,530	3,690	2,960	2,770	55
0	5,200	6,250	8,230	8,300	5,360	2,530	2,870	2,740	2,400
0	5,520	12,540	7,760	7,600	4,900	4,170	2,840	2,740	2,430
0	5,490	18,400	8,300	7,470	4,560	3,700	2,690	460	2,360
50	5,140	21,650	7,500	7,110	4,240	3,400	2,720	2,830	2,300
00	4,980	19,360	7,580	7,490	4,800	3,230	2,740	2,690	2,390
50	4,250	15,940	7,370	10,980	3,960	3,100	1,080	2,740	2,340
40	5,180	16,400	6,700	12,870	4,100	2,770	3,100	2,700	3,130
00	4,820	19,950	7,010	10,960	3,830	1,560	2,860	2,490	3,000
50	5,250	17,910	7,380	10,460	4,260	3,270	3,130	2,490	2,600
60	5,680	13,630	7,920	10,620	4,170	3,000	3,020	560	2,440
540	5,680	12,680	7,950	10,090	3,990	2,940	4,640	3,130	2,500
080	7,100	8,250	8,200	9,050	4,330	2,740	4,400	2,700	2,450
480	8,670	9,050	8,100	8,280	3,700	2,700	3,430	2,610	2,370
740	9,020	8,750	6,700	7,800	3,570	2,600	4,070	2,740	370
700	8,000	8,570	6,040	7,200	3,380	220	3,380	2,610	2,500
700	11,370	9,110	6,370	7,040	3,220	3,330	3,290	2,590	2,610
800	20,940	9,950	6,500	7,330	3,100	2,940	2,880	1,080	2,300
430	25,050	....	6,030	7,180	1,860	2,690	2,860	3,090	2,270
690	21,830	....	5,920	....	3,520	....	2,750	2,690	....

	ec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
	3,848	2,034	2,746	6,836	9,532	17,318	6,645	5,452	4,622	2,133
	2,777	273	2,585	10,794	9,839	14,806	6,067	4,826	3,720	2,259
	2,769	2.174	2,455	12,797	10,459	12,762	5,461	3,754	3,814	2,662
	2,458	2,415	2,605	19,860	10,457	12,308	5,577	3,564	4,350	1,147
	1,307	2,396	2,191	20,040	9,387	10,858	5,345	3,887	3,847	3,080
	3,461	2,202	717	15,930	8,816	9,918	5,711	3,553	2,732	3,059
	3,275	2,151	2,789	22,640	7,698	10,091	5,063	3,275	2,429	2,825
	3,189	1,870	2,695	19,110	8,363	10,583	4,893	3,012	3,411	2,679
	3,168	385	2,578	16,000	8,193	10,778	4,751	2,587	3,212	2,829
	3,058	2,878	2,571	20,350	9,563	10,609	4,949	1,507	3,419	2,791
	2,582	2,909	2,390	25,560	12,219	11,099	6,304	3,273	3,357	783
	1,140	2,462	3,040	29,420	18,052	14,727	8,130	3,101	3,142	2,987
	3,313	2,509	5,754	28,560	19,275	17,456	8,351	2,695	3,497	2,960
	3,172	2,610	10,207	25,500	18,505	15,324	6,979	2,570	1,386	2,804
	3,026	2,458	10,378	21,840	18,728	12,069	6,418	2,348	2,626	3,042
	3,105	1,352	9,535	19,750	19,796	11,330	6,107	2,639	2,762	2,903
	3,103	3,028	8,645	19,020	19,176	19,923	5,381	822	2,451	3,050
	2,828	2,967	7,529	17,918	19,400	28,258	4,897	2,303	2,370	854
	1,121	2,716	6,655	16,545	20,181	26,301	4,066	2,684	2,329	2,921
	3,289	2,702	5,757	15,843	19,934	25,355	4,683	2,415	2,353	2,648
	3,021	2,704	6,109	16,676	19,497	23,812	4,069	2,552	910	2,399
	2,685	2,487	5,410	17,791	19,705	20,074	3,969	2,466	2,359	2,246
3	2,623	1,113	5,255	18,053	20,930	17,851	4,039	2,628	2,830	2,307
4	2,546	3,119	5,230	16,713	20,455	15,404	3,726	739	2,494	2,791
3	1,084	2,976	4,976	14,743	21,499	13,267	3,333	2,963	2,359	833
2	1,764	2,749	4,413	13,097	23,682	11,385	2,391	3,105	2,455	2,707
5	3,111	2,496	3,756	11,726	22,894	9,405	3,823	6,369	2,941	3,348
3	2,982	2,710	5,201	8,682	20,792	7,823	3,845	8,267	983	3,164
8	2,727	2,438	....	9,544	19,623	7,062	4,089	6,545	2,435	2,651
7	2,405	1,229	....	9,322	19,275	7,183	4,871	6,549	2,686	2,527
..	2,178	2,915	....	9,628	....	6 566	....	4,397	2,347	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1881–82.												
1	2,530	4,257	4,083	21,734	7,521	8,380	12,707	8,208	16,138	3,593	2,702	2,122
2	519	4,598	6,237	15,769	6,791	13,180	10,914	7,656	14,420	3,129	2,420	1,668
3	2,800	4,382	9,300	9,282	6,454	24,975	11,065	7,375	16,173	4,270	2,218	358
4	2,705	4,173	7,843	6,309	6,036	35,030	11,747	7,127	12,848	3,724	2,330	2,302
5	2,449	4,932	7,046	7,282	5,204	33,070	12,312	6,662	14,733	4,726	2,370	2,340
6	2,448	6,306	6,007	7,617	5,457	28,680	13,657	6,155	19,408	4,177	784	2,349
7	2,431	5,574	5,824	7,565	4,851	26,280	14,329	6,013	16,446	4,046	2,515	2,027
8	2,877	4,791	6,029	7,010	4,993	23,680	13,348	6,063	13,355	3,890	2,684	2,157
9	876	5,219	6,363	7,613	5,000	19,152	12,200	5,493	11,370	3,087	2,426	1,858
10	2,646	7,164	5,897	8,364	5,169	18,172	13,531	6,522	9,844	3,833	2,404	535
11	2,552	7,471	3,820	8,641	5,409	20,186	12,930	7,667	8,644	3,478	2,192	2,254
12	2,372	6,224	4,052	8,219	4,918	19,932	11,775	7,764	8,449	3,123	2,642	2,548
13	2,375	4,606	3,641	7,766	5,647	18,570	10,465	7,697	7,384	3,362	825	2,576
14	2,312	5,795	3,985	7,096	6,348	16,326	9,513	8,033	6,368	3,301	2,696	2,510
15	2,466	6,047	5,020	6,152	8,560	14,506	8,892	10,128	5,991	3,484	2,679	2,314
16	725	5,800	5,461	6,769	13,800	12,710	7,764	12,198	5,718	3,302	2,459	2,820
17	2,363	5,076	4,722	6,064	15,900	12,058	8,397	12,926	5,326	3,883	2,167	784
18	2,709	4,638	3,910	5,508	19,200	11,415	8,259	10,836	4,868	3,360	2,458	2,818
19	2,526	4,752	4,889	5,102	18,277	10,467	8,889	9,417	5,811	2,943	1,582	2,789
20	3,375	6,440	4,768	5,145	18,342	11,123	9,755	8,488	7,573	2,946	502	2,513
21	4,146	8,518	4,598	4,865	16,080	11,209	11,860	8,977	10,606	2,950	2,358	2,310
22	3,267	7,362	4,509	4,486	13,463	11,627	12,529	11,534	9,692	3,193	2,466	2,346
23	1,946	6,320	4,735	4,814	11,801	11,315	10,717	12,793	7,456	1,249	2,430	1,951
24	3,344	4,331	9,105	4,508	10,971	10,576	9,688	14,167	5,887	2,831	2,166	5,711
25	2,801	4,875	16,865	4,199	10,309	9,812	8,348	19,157	4,436	3,042	2,221	16,636
26	2,409	4,108	11,080	4,271	9,513	8,542	7,494	16,333	5,016	2,455	2,065	14,747
27	2,489	3,316	9,440	5,120	9,668	8,324	6,909	14,098	4,009	2,410	783	9,850
28	2,966	4,477	14,240	7,204	9,086	9,619	7,049	12,424	4,295	2,170	2,398	6,764
29	3,546	3,827	24,260	8,489	....	14,534	7,493	15,132	4,236	2,247	2,428	5,296
30	1,259	3,638	23,600	9,121	....	15,647	7,629	24,069	3,899	749	2,368	4,237
31	3,075	....	29,295	8,305	....	14,604	....	21,448	....	2,462	1,957	....
1882–83.												
1	3,092	2,482	2,489	2,681	2,364	3,857	6,350	8,066	6,443	2,167	2,456	1,273
2	3,952	2,512	2,267	2,602	2,554	3,728	6,780	7,476	6,071	3,384	2,455	143
3	3,206	2,658	782	2,440	2,311	3,668	6,490	7,105	5,248	3,065	2,645	1,996
4	3,074	3,182	2,584	2,332	756	3,040	6,740	7,182	5,443	1,194	2,286	1,903
5	3,175	796	2,566	2,125	2,641	4,350	5,880	7,738	4,306	3,442	1,249	1,804
6	3,124	2,913	2,454	2,018	2,624	3,996	8,490	8,320	4,496	3,252	2,958	1,817
7	3,326	2,832	2,182	465	2,566	3,575	11,080	8,820	4,592	3,493	2,582	1,813
8	1,064	2,423	2,277	2,452	2,510	3,367	13,000	12,280	4,762	2,706	2,385	1,216
9	3,253	2,329	2,326	2,303	2,537	3,260	12,300	10,200	4,945	3,537	2,410	30
10	3,112	2,411	852	2,301	2,292	3,064	13,060	10,000	3,997	3,232	2,275	1,775
11	2,532	2,612	2,606	2,178	890	1,860	16,300	8,460	4,802	2,806	2,202	1,683
12	2,443	696	2,739	2,031	2,756	3,499	19,900	7,700	4,310	2,810	514	1,692
13	2,586	2,332	2,602	1,785	2,747	3,272	21,900	8,070	5,827	2,778	2,563	1,529
14	2,918	2,598	2,498	145	2,597	2,785	30,000	7,740	6,121	2,222	2,078	1,497
15	1,240	2,508	2,519	2,321	2,353	2,760	30,500	6,510	5,171	2,607	2,096	43
16	4,101	2,519	2,236	2,173	2,502	3,051	28,111	6,690	4,500	4,259	2,114	34
17	3,819	2,568	769	2,002	2,122	3,085	25,603	7,400	3,401	4,928	1,953	1,500
18	3,823	3,245	2,741	1,995	2,142	2,317	25,394	6,890	4,220	6,303	1,311	1,553
19	3,789	1,055	2,707	1,937	4,707	4,054	23,260	6,160	3,453	4,946	41	1,556
20	3,873	3,129	2,517	1,904	4,579	4,684	20,818	4,870	3,291	4,424	1,898	1,519
21	3,623	3,005	2,136	460	4,418	4,385	21,041	6,080	5,289	3,748	1,813	1,564
22	2,907	2,456	2,235	2,615	4,342	4,178	20,057	5,530	14,522	2,589	1,931	301
23	3,900	2,423	1,997	2,578	4,063	4,060	17,044	8,820	8,779	3,619	2,054	553
24	3,700	2,443	704	2,408	3,797	3,613	14,293	15,230	5,014	3,078	2,056	1,574
25	3,409	2,532	1,385	2,278	2,965	4,950	12,681	16,121	4,837	2,677	1,424	1,383
26	3,220	923	2,754	2,313	4,276	5,300	11,509	13,453	3,463	2,547	284	1,603
27	2,929	2,226	2,776	2,078	4,017	5,530	10,579	10,315	3,723	2,484	2,062	1,497
28	2,770	2,385	2,548	561	3,996	6,140	9,667	9,173	3,684	2,389	1,973	1,195
29	1,351	2,484	2,544	2,557	....	7,130	8,752	8,095	3,460	586	1,935	476
30	3,548	622	2,275	2,472	....	7,250	8,480	7,404	3,045	2,832	1,966	36
31	3,217	....	912	2,233	....	6,980	....	6,838	....	2,818	1,940	....

Merrimack River at Lawrence, Mass., for the years ending
30, 1880–1915—Continued.

		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
		4,118	4,348	8,280	28,940	16,400	7,620	3,222	2,302	2,470
		4,182	4,441	8,240	25,030	14,390	7,000	2,539	2,081	2,940
		4,163	4,036	8,370	21,800	13,630	5,530	2,344	362	2,799
		3,976	4,844	7,380	22,360	12,800	5,770	1,230	2,811	2,657
		3,999	4,533	7,167	23,860	13,080	5,490	1,637	2,793	2,226
		3,010	4,199	6,669	20,910	12,120	5,170	2,154	2,237	2,229
		4,068	5,481	6,512	20,350	12,250	4,480	3,318	2,257	638
		3,438	6,830	6,382	20,230	11,460	4,060	3,014	2,340	2,350
		4,173	7,495	5,804	21,000	10,760	4,890	2,542	2,174	2,348
	5	5,942	7,157	6,408	22,420	10,020	3,710	2,467	780	2,204
	5	7,789	7,171	6,086	24,660	10,360	4,213	2,309	3,023	1,925
	7	8,306	6,449	6,228	26,120	11,820	4,776	2,142	2,688	2,135
	5	7,206	6,166	7,953	26,150	10,920	4,921	553	2,617	1,546
	2	6,852	6,789	11,121	26,270	10,000	4,212	2,837	2,299	140
	0	5,891	8,834	13,266	25,250	10,550	3,527	2,474	2,389	2,367
	94	5,291	10,150	13,240	26,730	12,480	4,349	2,272	2,009	2,344
	18	4,824	9,828	12,751	35,640	10,920	3,527	2,280	514	2,328
	07	4,383	11,579	11,659	39,100	11,590	3,406	2,396	2,465	2,302
	79	3,995	14,633	10,883	41,100	10,850	3,546	1,830	2,624	2,043
	32	3,135	16,597	10,986	38,050	9,120	3,350	554	2,445	1,160
	60	4,375	16,815	11,845	35,580	10,050	2,698	2,725	2,415	38
	31	4,164	17,145	12,200	32,490	17,180	2,315	2,756	2,290	2,169
	207	3,481	16,983	14,240	29,340	16,180	3,530	2,403	1,661	2,274
	748	3,727	14,915	19,210	25,000	12,880	3,235	2,402	957	2.252
	146	4,267	15,663	24,720	22,510	13,630	2,772	2,407	3,186	2,099
	720	4,339	13,515	29,100	22,180	12,590	2,929	2,485	2,605	2,027
	180	3,968	11,678	36,190	20,880	11,570	3,229	1,126	2,459	1,394
	218	4,876	10,779	42,200	21,930	9,590	3,561	3,233	2,203	266
	281	4,303	9,606	46,600	21,190	9,930	1,307	2,932	2,206	2,486
	,370	4,111	....	41,000	18,900	11,850	3,598	2,227	2,106	2,304
	,340	4,171	....	35,300	....	8,600	....	2,281	360	....
	,660	3,610	3,081	2,875	3,960	19,610	4,730	4,010	1,970	3,370
	,140	6,520	3,954	4,281	5,440	17,340	5,190	4,225	630	4,000
	,100	7,960	3,756	4,292	14,340	14,390	5,280	3,669	3,980	4.090
	2,620	5,280	3,445	4,527	18,980	13,920	5,330	2,554	4,200	3,670
	2,230	3,640	3,384	4,689	23,420	11,500	5,190	2,864	6,380	3,350
	2,010	2,910	3,424	4,803	24,240	10,500	6,270	3,409	15,930	1,990
	1,405	4,910	3,321	4,754	22,420	9,320	11,130	3,299	9,590	3,560
	5,150	7,800	2,802	4,124	21,250	8,440	10,820	4,285	5,160	3,020
	9,380	7,060	3,611	4,936	22,420	8,490	8,000	3,928	4,200	2,940
	7,100	5,910	4,079	4,441	22,450	10,580	6,600	4,607	4,750	3,040
	5,300	5,140	5,690	4,152	20,980	11,200	5,640	3,874	3,450	3,070
	4,410	4,080	6,290	4,086	17,440	9,930	4,700	3,229	3,320	5,390
	3,940	6,790	6,900	4,022	17,380	8,400	4,160	3,817	3,480	3,860
	2,720	11,030	7,060	3,697	15,890	7,020	3,220	3,097	3,690	4,160
	4,230	8,660	5,877	2,744	15,280	7,790	3,770	2,881	20,320	3,210
	3,540	5,170	6,006	4,085	17,690	7,870	3,200	2,651	16,100	2,950
	3,850	3,840	5,464	3,743	17,380	7,810	2,530	2,526	8,230	2,680
	4,460	3,140	5,376	3,592	16,040	7,880	2,710	2,519	5,660	2,550
	4,040	4,010	5,038	3,618	14,670	7,390	2,690	1,576	4,320	2,400
	5,020	3,470	4,694	3,314	16,400	7,370	2,490	3,096	3,580	1,076
	1,850	3,300	4,324	2,884	17,510	7,210	1,180	2,742	3,480	2,240
	5,370	3,740	3,585	2,330	19,700	6,670	2,950	2,301	3,510	2,788
	5,570	4,760	4,250	2,960	22,570	5,700	2,670	2,130	2,460	2,150
	6,680	3,890	3,907	2,580	24,700	5,540	2,180	2,179	5,000	2,158
0	5,590	3,440	3,715	1,830	24,270	6,520	2,195	1,920	4,350	2,124
0	8,040	3,760	3,604	1,940	21,650	5,470	2,114	480	4,230	2,560
0	6,960	5,030	3,771	1,550	19,150	5,440	1,872	2,020	4,200	580
0	6,020	5,750	3,573	2,100	16,500	4,930	987	2,070	3,800	2,804
0	6,530	8,610	....	3,450	15,900	4,210	3,269	2,110	3,260	2,704
0	5,480	6,280	....	3,900	19,680	3,320	3,579	2,170	1,660	2,232
.	5,790	5,350	....	3,530	....	3,220	....	2,100	3,900	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years endin Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1885–86.												
1	2,304	5,843	5,210	5,780	11,054	23,040	24,020	8,080	4,120	2,795	777	2,19
2	2,142	6,492	5,270	14,200	9,978	23,000	39,070	7,820	3,980	2,396	2,787	2,20
3	2,866	9,123	4,710	14,600	8,910	20,910	40,700	7,400	3,840	2,753	2,620	2,17
4	494	16,897	4,540	16,000	7,954	19,180	34,810	6,790	3,770	1,153	2,307	2,19
5	2,608	13,692	4,360	14,710	7,066	17,040	27,100	6,250	3,620	806	2,291	31
6	2,808	9,926	3,450	32,980	6,736	14,170	22,570	6,070	2,910	2,979	2,323	2,40
7	2,767	8,130	4,650	38,400	5,893	10,680	27,600	6,150	4,180	2,586	1,868	2,33
8	3,309	7,092	4,240	27,080	6,542	11,210	31,090	5,810	3,340	2,315	279	2,20
9	3,162	11,219	3,230	14,940	6,153	9,410	27,880	6,520	3,080	2,240	2,769	2,10
10	3,624	23,920	4,350	9,960	6,128	8,620	24,260	10,160	2,930	2,009	2,522	2,13
11	772	24,720	8,620	15,180	6,105	7,660	23,100	9,910	2,800	495	2,387	1,53
12	2,433	19,050	14,170	16,400	7,192	7,330	23,500	8,600	3,278	2,159	2,334	13
13	2,816	13,500	11,200	16,100	22,150	6,680	22,270	8,460	1,372	1,897	1,984	2,27
14	2,925	10,330	10,920	16,420	39,200	6,950	21,080	7,830	3,472	2,118	1,558	2,00
15	2,895	8,740	13,350	14,210	46,100	7,210	22,370	7,090	3,366	2,366	235	2,05
16	3,178	7,830	13,830	13,570	43,300	7,020	25,120	7,010	3,396	2,340	2,253	2,06
17	4,266	6,690	10,950	11,400	36,900	6,940	25,500	8,260	4,223	1,879	2,400	2,03
18	1,031	5,940	8,760	12,520	34,260	7,770	23,190	10,440	4,375	2,201	2,340	1,78
19	3,386	5,530	7,930	11,300	28,610	8,800	23,190	8,750	4,597	3,585	2,327	29
20	3,270	5,420	7,320	11,010	26,480	9,680	23,680	7,380	2,240	3,016	2,318	2,62
21	2,665	5,880	6,420	9,980	24,350	10,680	23,640	6,150	3,603	2,730	3,027	2,52
22	2,962	5,660	5,660	6,596	23,190	13,280	21,960	5,400	3,332	2,744	523	2,27
23	7,265	5,660	5,590	6,679	18,180	13,640	20,100	4,830	2,727	2,609	2,552	2,23
24	8,940	4,920	6,380	6,045	16,000	12,160	18,200	5,370	2,663	3,193	2,573	2,21
25	5,746	5,440	5,730	6,433	14,930	10,890	14,600	4,560	2,782	786	2,356	2,30
26	5,277	4,500	8,300	6,308	13,660	9,740	14,180	4,320	3,343	2,267	2,143	45
27	4,149	6,660	5,900	7,106	11,370	10,030	11,380	4,480	1,271	2,439	2,208	2,81
28	3,903	6,000	6,000	7,106	15,360	10,540	9,900	5,620	3,590	2,289	1,396	3,00
29	3,770	5,020	5,460	7,210	....	13,840	8,790	5,570	3,088	2,113	132	2,46
30	4,037	5,750	5,060	8,893	....	15,290	8,380	5,240	2.637	2,100	1,995	2,20
31	4,413	....	4,870	10,071	....	19,640	....	5,140	....	3,182	2,075	.....
1886–87.												
1	3,662	5,779	6,360	6,150	32,400	8,180	11,430	33,900	10,180	5,650	9,490	7,20
2	5,031	7,267	7,140	5,270	26,800	7,340	10,750	30,500	10,360	4,280	8,070	6,60
3	1,233	5,732	8,840	7,180	23,200	6,940	8,200	25,500	11,680	3,210	7,620	5,71
4	2,721	4,703	5,300	7,020	19,400	7,000	10,150	23,500	12,300	3,220	7,340	4,97
5	2,618	3,985	4,110	5,730	18,100	6,230	12,440	22,200	13,180	4,600	6,250	5,94
6	2,310	4,875	5,780	5,380	13,870	4,970	15,210	23,600	12,300	3,880	4,810	4,64
7	2,315	2,095	4,770	5,160	13,820	6,240	15,470	20,750	10,080	3,920	4,990	4,33
8	2,298	4,701	5,730	4,570	12,200	5,395	15,450	17,400	8,770	5,000	6,940	4,86
9	2,411	7,048	4,410	3,600	11,530	5,790	14,560	17,700	7,450	3,930	6,350	5,02
10	417	6,097	4.900	4,620	10,700	5,790	15,060	18,200	6,510	3,495	5,270	4,39
11	2,277	4,974	4,740	4,550	9,870	6,510	24,700	17,400	5,540	4,640	4,690	4,45
12	2,401	4,409	4,110	4,330	11,390	6,780	36,000	15,470	4,830	4,310	4,580	4,72
13	2,246	4,230	5,160	4,340	10,320	6,300	40,700	12,910	5,460	4,620	4,520	4,28
14	2,307	3,762	4,630	4,490	12,220	7,460	37,500	10,890	4,160	4,950	4,330	4,46
15	2,242	4,294	4,740	4,400	8,840	7,690	31,100	8,630	4,110	4,160	4,600	4,84
16	1,711	3,787	4,710	3,600	8,400	8,020	27,200	9,110	3,880	3,080	3,720	4.66
17	365	3,839	5,620	5,060	8,960	7,480	25,950	8.020	3,780	2,260	3,560	3,80
18	2,021	4,217	4,270	4,380	9,280	7,590	24,400	8,510	3,010	3,800	3,560	3,43
19	2,126	8,772	3,780	4,340	11,220	7,530	22,300	8,090	1,255	3,440	9,660	4,17
20	2,291	21,930	5,530	4,310	12,530	8,300	20,400	7,610	4,000	3,060	12,550	3,50
21	2,295	14.140	5,510	4,340	14,450	10,530	19,550	6,565	3,530	3,295	9,460	3,23
22	2,122	10,460	5,350	4,360	12,780	11,690	19,950	5,610	3,000	3,440	8,900	3,53
23	1,595	7,580	5,100	3,350	11,090	12,150	21,300	6,460	3,350	2,530	11,050	3,44
24	53	7,310	4,730	4,900	9,660	10,630	22,200	4,490	5,760	4,930	13,320	2,62
25	2,109	7,880	4,420	8,480	10,250	10,630	25,800	4,870	25,550	21,200	19,250	1,75
26	2,315	12,500	9,100	13,690	9,750	10,390	28,800	4,720	22,000	23,000	22,200	3,42
27	2,014	11 500	11,400	16,400	7,350	8,840	27,400	9,140	14,460	21,000	18,650	3,16
28	2,064	9,040	10,690	15,590	9,710	10,580	26,000	10,160	10,750	15,200	12,750	2,96
29	2,200	7,720	8,760	15,800	....	13,170	24,300	11,040	8,040	11,870	10,840	2,97
30	1,677	6,340	7,260	23,500	....	12,980	31,400	12,940	6,530	11,150	8,580	2,85
31	3,284	....	8,090	33,600	....	12,030	....	12,360	....	9,780	7,660	.....

errimack River at Lawrence, Mass., for the years ending , 1880–1915—Continued.

n.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,339	4,040	15,500	27,100	38,800	12,000	3,100	2,770	1,810
,882	3,990	13,400	27,400	37,000	11,910	4,420	2,690	550
,942	4,020	12,300	28,200	31,400	10,260	3,090	2,650	2,600
,081	2,740	3,340	26,600	25,400	9,660	1,930	1,730	3,280
,149	2,750	5,420	24,100	22,400	8,020	3,920	140	2,970
9,689	4,470	4,610	26,200	19,000	7,460	3,440	2,590	2,850
8,686	4,410	4,300	32,200	19,400	6,935	2,330	2,790	2.710
7,842	4,480	4,070	33,200	19,900	5,570	430	2,770	1,850
7,776	4,525	3,920	30.650	20,400	6,540	3,250	2,770	440
6,827	4,340	3,610	26,400	21,600	5,260	3,080	2,690	3,480
6,336	3,055	1,760	24,400	24,500	6,140	2,700	1,800	4,020
5,821	2,880	3.600	24,000	25,800	4,560	2,700	350	3,750
5,779	4,340	5,560	24,250	31,000	4,620	2.640	3,230	3,510
5,481	4,070	4,050	21,000	37,400	4,410	1,700	3,500	3,400
5,433	4,180	3,000	22,000	33,800	4,385	730	3,550	2,320
6,176	3,990	3,030	21,250	28,800	3,900	3,410	4,010	510
5,735	4,070	3,350	21,200	24,400	3,510	3,130	3,610	3,320
5,553	2,840	1,860	21,850	21,000	4,860	2,720	2,740	3,450
5,472	2,750	3,510	23,400	18,550	3,490	2,760	1,440	4,240
5,613	4,170	3,060	22,800	15,080	3,680	2,790	3,290	10,250
5,675	11,600	3,520	24,600	14,920	3,720	1,750	3,300	8,900
5,227	14,700	13,800	23,350	13,670	3,680	460	3,070	15,170
6,302	19,500	20,100	22.650	12,840	2,880	2,900	3,070	21.400
5,443	22,300	25,600	23,000	12,100	2,130	3,060	3,070	18,500
4,401	22,500	23,600	23,000	11,820	4,040	2,700	2,650	13,370
4,467	19,600	20,200	20,550	11,455	3,520	2,770	1,180	11,430
4,580	21,300	18,200	20,200	9,680	7,270	2,710	3,240	15,640
4,253	19,900	18,800	21,200	10,270	5,720	1,720	3,140	21,450
3,562	18,400	20,800	23,800	10,180	6,200	220	2,730	15,870
5,113	....	23,200	33,600	12,510	3,830	2,610	2,695	11,310
4,283	....	27,400	....	13,470	....	2,700	2,740	....
11,930	8,100	4,300	9,910	13,460	4,240	3,940	9,960	1,140
11,320	7,250	3,730	9,860	11,480	4,300	2,940	10,260	2,860
10,500	6,840	3,540	10,620	9,780	6,740	2,920	11,420	3,070
9,840	8,580	4,840	10,180	8,280	11,580	1,240	9,420	2,510
9,040	6,360	5,460	12,220	6,950	9,160	3,800	9,580	2,540
8,260	6,780	11,150	13,100	7,920	7,780	3,400	8.500	2,500
11,630	6,290	20,000	11,300	6,420	7,100	3,500	7.770	1,610
14,310	7,390	22,400	11,980	6,140	5,840	4,000	6,910	380
19,000	6,140	19,800	11,220	5,990	5,600	3,320	5,530	3,070
18,000	5,930	14,320	11,150	5,700	7,020	2,900	4,440	2,710
23,000	7,360	13,000	11,430	4,810	7,020	2,800	3,940	2,630
21,000	5,920	11,220	11,300	4,560	9,400	2,810	5,110	2,600
15,080	5,700	10,030	11,480	5,570	8,420	1,910	4,230	2,560
13,580	5,920	10,130	11,020	4,500	7,120	1,450	4,070	1.640
11,740	6,120	10,740	11,320	4,540	5,330	3,450	4,360	1,400
10,210	5,120	10,540	9,800	5,000	4,620	3,300	4,840	3,240
9,870	4,880	8,780	9,400	4,710	5,380	2,670	4,540	3,000
15,160	6,680	10,080	9,240	3,920	4,940	2,760	4,300	2,730
20,400	6,830	10,060	9,700	3,300	4,540	2,810	4,870	4,300
14,200	7,610	11,850	11,320	4,240	4,550	2,280	4,100	6,900
11,200	7,020	12,930	11,700	4,390	4,140	2,700	3,760	9,230
8,740	6.580	12,180	13,130	7,820	2,980	11,090	3,740	6,870
9,740	6,100	11,600	11,580	12,700	2,400	7,130	3,590	6,270
9,520	4,800	10,700	9,580	10,700	3,780	5,280	2,600	5,770
9,910	5,480	12,500	8,030	7,870	3,440	4,540	2,240	4,680
10,080	5,100	13,220	6,940	5,700	2,740	3,800	3,690	4,150
8,680	4,440	12,200	8,060	6,510	3,040	2,980	3,340	3,920
9,300	4,280	11,130	12,960	5,200	3,100	2,450	2,710	2,980
8,700	....	10,420	17,350	6,160	2,150	4,620	2,640	3,290
8,800	....	10,520	17,390	5,740	3,240	4,330	2,550	4,390
8,400	....	8,780	....	5,260	....	4,750	1,620	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years endi Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1889–90.												
1	**3,310**	7,200	20,050	7,550	4,090	21,000	14,200	11,980	12,880	3,480	3,280	9,5
2	**3,450**	5,870	15,440	8,380	4,070	20,900	13,560	11,930	10,980	2,520	3,020	8,4
3	**6,680**	5,020	13,100	9,080	4,360	17,700	11,630	12,930	9,100	2,580	770	6,4
4	**6,730**	8,160	11,980	10,480	3,750	13,640	12,820	10,900	8,420	900	2,910	5,4
5	**4,830**	17,700	9,420	9,810	4,320	12,730	19,000	11,680	7,850	5,060	2,980	4,7
6	**3,790**	12,720	7,730	9,020	6,090	11,950	23,200	17,900	9,130	6,470	2,300	4,0
7	**5,210**	10,400	8,330	8,410	7,370	8,150	22,750	22,000	12,960	5,340	2,240	3,3
8	**8,770**	8,230	7,380	9,080	6,460	8,490	22,100	24,500	13,900	3,770	2,170	4,9
9	**13,700**	6,760	9,590	9,080	11,220	10,150	22,200	20,250	12,000	3,460	2,120	3,9
10	**10,480**	5,790	17,450	5,950	13,210	9,170	22,400	15,280	9,620	3,400	795	4,2
11	**8,070**	6,730	23,000	5,550	10,650	8,600	22,900	12,500	8,380	3,120	1,800	4,6
12	**6,250**	5,530	20,000	5,150	8,600	8,580	22,400	15,070	7,620	2,940	2,280	5,1
13	**5,710**	5,420	19,500	4,800	7,230	10,520	19,400	14,480	7,270	620	1,920	5,5
14	**7,250**	5,460	15,520	5,280	6,570	17,340	20,050	12,480	9,940	3,300	1,920	6,9
15	**6,850**	6,090	11,560	5,780	6,650	20,600	21,900	11,920	11,410	3,100	1,940	13,6
16	**6,490**	5,800	10,440	6,330	8,560	19,500	24,350	15,280	10,260	2,340	1,880	13,7
17	**5,530**	4,830	9,680	8,490	8,960	19,300	22,400	14,860	9,010	2,300	590	12,5
18	**5,020**	5,590	10,130	8,040	8,170	16,170	19,100	14,190	8,160	2,440	2,110	15,2
19	**4,060**	4,330	11,360	8,340	6,500	14,800	17,100	11,880	7,160	2,320	2,330	22,9
20	**3,480**	5,270	15,500	7,120	5,900	12,700	13,470	10,430	6,190	620	2,310	19,3
21	**4,930**	8,560	18,950	6,880	4,650	12,380	13,440	11,680	5,660	2,260	2,440	14,7
22	**3,980**	11,010	15,100	8,130	5,050	12,960	12,720	17,300	4,550	2,640	2,650	10,7
23	**3,540**	12,290	14,640	7,700	3,900	17,600	12,340	13,460	5,560	2,330	2,910	8,7
24	**3,660**	11,720	13,030	6,040	6,810	25,200	12,290	10,950	4,340	2,360	950	7,0
25	**3,570**	10,910	10,560	5,460	6,560	23,450	13,150	9,580	4,000	2,460	6,220	6,6
26	**2,730**	9,070	13,440	4,510	8,480	20,400	14,160	8,740	4,400	2,340	8,060	5,8
27	**2,260**	8,070	13,840	7,350	16,700	20,300	11,860	7,980	4,510	4,760	6,480	5,4
28	**4,450**	8,560	12,050	4,700	21,300	20,700	13,100	15,590	4,150	6,560	5,700	5,1
29	**5,180**	22,400	9,150	4,400	....	19,500	13,340	22,100	2,850	4,830	12,700	6,6
30	**8,820**	23,800	9,990	4,280	....	15,840	13,000	18,000	4,160	4,100	8,960	5,4
31	**8,270**	....	8,960	4,440	....	15,370	....	15,000	....	3,270	6,840	....
1890–91.												
1	**5,000**	14,300	6,820	7,600	12,000	25,800	24,200	10,600	5,620	3,070	2,460	3,8
2	**4,900**	13,380	4,850	7,420	13,720	21,900	21,700	9,640	4,980	2,590	950	3,5
3	**4,550**	11,580	4,310	7,520	13,800	18,000	22,900	9,210	5,220	2,810	3,310	3,2
4	**4,480**	10,730	4,380	6,750	14,640	15,300	22,300	9,970	5,680	1,750	3,240	2,8
5	**4,760**	10,210	4,470	8,120	15,160	13,060	21,500	9,760	6,440	2,690	2,450	2,8
6	**6,780**	9,290	4,760	7,560	12,890	13,200	21,000	9,430	7,600	3,610	2,240	1,8
7	**5,840**	8,850	4,400	7,410	11,800	13,080	19,600	8,500	6,310	3,230	2,170	2,6
8	**5,700**	8,460	6,240	7,000	10,130	13,300	18,500	7,810	5,810	3,310	2,170	3,7
9	**6,480**	7,740	5,120	6,540	11,370	11,750	17,100	7,150	4,520	3,390	770	3,3
10	**7,540**	8,080	5,010	6,090	9,730	13,900	15,780	6,690	4,040	3,510	2,070	3,3
11	**7,290**	7,200	4,870	4,760	10,850	23,300	17,000	7,020	4,040	3,610	2,740	2,9
12	**6,340**	7,640	4,820	8,820	10,850	27,900	17,900	6,680	3,820	2,360	2,140	2,7
13	**6,340**	7,600	5,090	11,320	9,950	27,800	28,100	7,660	3,570	3,670	2,100	1,6
14	**5,180**	7,100	4,180	15,260	9,660	30,800	31,700	7,150	2,430	3,170	2,145	3,2
15	**5,170**	6,840	5,190	21,300	7,870	32,500	29,900	6,480	3,630	2,280	2,000	2,9
16	**5,480**	6,290	4,880	15,700	8,260	30,800	30,300	6,360	3,270	2,310	640	2,3
17	**7,170**	7,150	4,700	13,560	9,270	25,100	29,600	7,400	2,540	2,340	2,220	2,2
18	**15,500**	8,100	5,120	12,700	11,980	21,600	26,600	11,270	2,870	3,050	2,860	2,4
19	**21,800**	13,700	6,950	12,200	14,600	20,000	24,900	9,640	3,100	800	2,550	2,3
20	**25,600**	15,260	9,340	11,020	15,520	18,100	26,800	7,950	4,340	3,360	2,180	6
21	**31,450**	12,430	7,000	10,210	13,820	15,620	27,500	6,990	3,820	4,040	2,180	2,2
22	**29,600**	10,560	7,920	9,850	13,520	17,600	24,200	6,160	4,650	3,840	2,000	2,5
23	**24,000**	9,020	6,150	15,600	13,540	28,200	20,600	6,320	4,440	3,350	870	2,3
24	**19,300**	8,380	5,660	24,900	11,660	38,100	20,200	6,410	5,890	3,070	4,220	2,4
25	**18,400**	7,100	3,660	32,200	12,890	41,200	20,900	6,510	6,380	2,790	3,280	2,3
26	**19,500**	7,140	6,960	31,700	20,600	39,000	15,470	5,170	5,280	730	3,150	2,2
27	**19,300**	5,040	13,560	24,200	28,100	33,200	13,770	5,190	4,680	3,600	2,880	5
28	**17,000**	7,290	11,350	20,700	29,800	27,600	12,380	4,650	3,190	3,130	2,800	2,2
29	**13,700**	5,530	13,010	17,100	....	24,100	11,700	4,540	4,400	2,840	2,640	2,1
30	**13,100**	4,130	12,160	14,070	....	24,700	11,480	4,570	3,700	2,840	3,710	2,3
31	**14,480**	....	10,820	13,060	....	25,600	....	4,890	....	2,600	5,120	....

of Merrimack River at Lawrence, Mass., for the years ending pt. 30, 1880-1915—Continued.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11,490	7,170	5,035	9,380	5,170	10,130	9,960	3,045	8,260
6,980	5,100	5,610	9,640	5,400	9,610	9,500	3,020	6,550
6,230	5,040	8,740	10,630	4,410	8,260	8,100	2,790	5,550
19,100	4,890	13,510	13,320	5,350	7,250	6,510	2,800	4,520
15,520	5,100	4,050	16,600	7,400	6,100	13,030	2,760	3,460
9,340	5,270	3,790	16,500	9,600	6,445	12,980	1,850	4,410
5,300	4,050	4,580	14,560	8,040	4,940	9,890	505	3,700
4,360	5,170	4,350	15,960	6,070	5,765	7,610	2,980	3,800
4,140	4,540	4,840	12,610	5,820	5,160	5,560	3,105	3,815
3,670	4,180	6,710	10,850	4,750	4,970	4,725	2,735	3,020
4,360	4,450	10,210	9,780	4,300	4,155	5,590	2,760	765
3,170	5,650	12,360	8,280	4,540	3,640	4,280	2,690	3,590
3,200	5,710	10,720	7,370	5,200	4,980	3,845	1,880	3,395
4,810	5,290	10,230	6,630	7,330	3,800	3,800	4,975	2,900
12,700	3,960	7,430	5,940	7,850	3,750	3,600	6,115	3,125
20,400	3,540	6,940	5,700	8,830	3,720	2,815	4,940	6,960
14,500	4,130	6,180	4,720	10,050	3,590	1,170	3,920	7,280
10,560	4,480	5,800	5,780	10,260	3,540	3,520	3,530	4,755
9,820	3,390	5,260	4,820	8,240	2,960	3,345	3,380	5,140
10,780	2,720	4,640	4,410	7,120	4,570	2,895	2,360	3,700
11,610	1,890	5,660	4,410	7,700	3,760	2,950	1,330	3,545
9,540	3,040	4,500	4,430	13,110	3,070	2,850	3,770	3,480
7,460	2,900	4,480	5,020	21,600	3,760	1,940	3,415	3,240
7,640	2,900	5,450	5,920	24,800	3,590	640	3,120	2,370
8,740	3,270	7,770	6,580	24,500	3,620	2,760	2,760	565
7,300	3,570	8,380	5,660	20,100	2,980	2,880	2,690	3,480
5,920	3,980	9,420	5,040	16,650	11,070	2,805	3,965	3,265
7,020	4,550	10,590	4,660	14,740	10,040	2,805	18,770	3,030
6,090	4,830	10,180	4,645	15,290	11,220	2,805	21,600	3,300
5,720	....	10,180	4,645	12,390	14,120	1,960	14,680	3,355
6,780	....	9,640	....	10,610	....	360	10,820	....
710	2,423	4,024	11,270	14,530	6,845	2,865	2,592	6,246
3,597	2,466	4,074	12,420	15,620	6,500	1,660	2,316	4,122
6,762	2,427	3,898	15,740	16,900	5,560	2,540	2,196	3,229
6,869	1,726	3,523	15,220	20,700	5,240	2,070	2,166	3,138
5,218	1,142	3,096	14,200	39,000	6,030	3,665	1,454	3,987
4,111	3,091	4,281	14,130	44,800	4,595	3,480	435	2,611
3,374	2,708	3,918	15,690	37,800	4,660	2,675	2,729	2,155
3,051	2,689	3,695	14,700	29,450	5,000	1,730	2,660	2,777
4,268	3,506	3,811	13,300	21,900	4,825	1,545	2,283	1,714
3,411	4,889	4,234	17,190	19,300	3,885	3,380	1,836	2,229
3,057	8,176	4,545	18,800	17,800	3,115	3,255	2,284	3,723
2,767	9,553	5,891	17,520	18,200	4,570	2,680	1,703	2,667
2,734	11,493	9,442	17,900	18,350	3,480	2,750	1,721	2,975
1,940	9,147	14,031	19,100	17,500	4,550	2,800	3,168	2,304
1,622	7,564	22,158	18,800	19,420	4,320	1,805	2,314	2,599
3,282	7,120	25,808	20,100	18,200	3,955	305	2,286	1,530
3,083	6,958	24,558	19,200	18,800	3,140	3,140	1,985	1,211
2,769	6,460	21,010	17,400	30,000	3,495	2,800	2,345	3,561
2,760	5,680	16,824	15,250	32,600	4,410	2,700	1,295	3,425
2,470	6,274	14,315	14,080	24,450	3,795	2,690	811	3,304
1,959	4,994	12,129	14,100	18,700	3,600	2,665	2,955	3,275
751	4,725	11,132	15,550	16,900	3,540	1,700	2,515	2,945
3,060	4,530	10,426	15,370	14,850	3,720	310	3,331	1,751
2,355	4,418	9,400	15,830	13,320	3,460	2,590	2,436	1,390
2,559	3,649	9,660	14,970	12,300	4,200	2,650	3,429	3,215
2,129	3,277	12,840	14,900	11,620	5,160	2,605	2,713	2,577
2,504	4,442	16,200	14,080	9,730	4,420	2,615	4,078	2,739
1,878	4,325	15,250	12,010	8,150	4,160	2,600	4,466	2,193
768	....	14,200	13,620	9,000	4,060	1,670	2,932	2,423
,003	....	12,150	12,460	7,500	3,825	970	4,042	1,430
,612	....	11,890	....	7,230	....	3,140	6,554	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years en
Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1893–94.											
1	1,188	6,290	7,010	4,490	2,850	6,220	7,000	9,450	15,150	2,183	2,199
2	3,030	5,180	5,380	3,680	2,950	5,020	9,080	8,000	12,900	3,393	2,007
3	2,633	4,530	4,540	2,880	2,490	4,700	9,100	8,080	10,020	2,698	2,066
4	2,282	3,350	5,180	2,760	1,000	3,100	9,080	8,580	14,220	762	1,459
5	2,244	2,900	4,490	2,650	2,900	6,680	8,650	7,920	14,400	3,628	255
6	2,197	4,810	4,280	2,630	2,700	8,080	9,100	5,500	11,950	3,273	2,524
7	1,486	4,060	4,900	3,000	2,730	13,950	8,880	7,620	10,200	2,018	2,447
8	286	3,140	5,355	4,220	1,820	22,400	6,720	7,400	9,130	1,509	2,225
9	2,513	3,500	4,410	3,410	2,000	27,900	9,120	7,680	8,000	3,712	2,031
10	2,582	3,490	4,060	3,200	2,010	26,130	8,220	6,900	5,050	3,031	1,933
11	2,330	2,540	5,900	3,220	1,200	21,350	8,650	6,320	5,790	2,491	1,285
12	2,324	1,690	4,460	2,700	3,040	20,430	9,600	5,400	4,335	2,340	200
13	2,241	3,720	4,280	4,800	4,640	20,000	10,500	2,880	4,240	2,367	2,130
14	1,389	3,490	5,990	1,000	3,780	19,650	10,580	4,870	4,035	1,562	2,182
15	853	2,880	5,000	3,910	2,500	19,080	9,000	3,530	3,880	1,086	2,038
16	4,881	2,880	3,970	3,160	4,520	16,580	11,900	3,260	2,790	3,162	1,979
17	4,641	2,805	3,580	2,775	4,090	14,580	11,380	3,580	2,500	2,807	1,958
18	3,852	1,970	6,600	2,990	2,380	11,900	11,800	3,480	3,900	2,622	1,368
19	3,245	1,430	5,680	2,950	4,940	13,550	9,450	2,540	3,260	2,207	257
20	2,918	3,460	5,860	2,880	4,490	14,500	10,400	2,905	2,885	2,205	1,829
21	1,736	3,240	6,290	1,500	7,320	18,320	10,580	6,350	2,900	1,480	2,074
22	1,072	2,700	4,960	2,790	7,320	17,600	13,320	6,200	4,350	223	2,078
23	3,544	2,780	3,815	2,800	7,020	15,700	20,880	6,200	3,165	3,213	1,806
24	3,128	3,680	3,240	2,110	9,600	16,050	19,700	5,680	2,700	2,371	1,694
25	3,560	3,280	3,370	2,310	6,390	13,400	17,620	6,550	4,175	2,562	1,229
26	11,180	2,900	6,140	2,750	8,520	14,300	16,200	10,250	3,500	2,325	193
27	7,900	3,960	7,665	3,000	8,120	13,300	14,320	10,030	2,880	2,263	1,687
28	5,400	3,060	8,445	2,000	6,350	11,900	12,100	10,300	2,920	1,445	1,790
29	5,690	2,850	7,910	3,300	....	10,200	9,000	9,200	3,455	436	1,793
30	11,380	4,420	6,420	2,830	....	9,900	10,620	10,980	2,310	2,573	1,876
31	8,320	....	6,045	5,000	....	9,170	....	19,130	....	2,667	1,947
1894–95.											
1	2,869	2,515	1,990	2,534	2,787	2,481	8,160	9,950	4,701	4,274	2,615
2	2,126	2,647	1,296	2,567	1,904	1,609	6,820	9,814	3,462	3,211	2,627
3	2,144	2,429	3,492	2,630	1,579	1,595	6,740	9,155	4,572	3,316	1,781
4	2,161	3,045	2,991	2,425	3,432	3,381	6,920	8,198	4,021	1,592	1,096
5	2,009	5,818	2,818	1,826	2,985	3,377	8,190	7,629	3,308	4,045	3,409
6	1,409	5,935	2,727	710	2,815	3,560	7,740	8,305	3,812	1,883	2,757
7	209	5,196	2,570	3,233	2,619	3,247	7,140	8,557	4,040	1,577	2,529
8	2,055	4,864	1,801	2,526	2,302	3,193	9,320	8,596	3,685	3,877	2,247
9	2,206	4,170	1,140	2,470	1,743	2,909	10,080	7,994	3,371	2,590	2,273
10	2,275	3,481	3,490	2,544	884	3,327	25,400	6,632	4,292	2,785	1,734
11	2,433	2,961	2,811	2,905	3,205	4,785	39,200	5,735	3,546	3,325	409
12	2,047	4,209	2,625	1,849	2,577	5,030	33,600	5,083	3,046	3,515	3,050
13	1,863	3,852	2,639	1,884	2,546	4,618	24,100	5,693	2,992	2,028	2,609
14	2,180	2,856	3,096	3,951	2,413	5,683	19,600	7,189	2,682	1,801	2,419
15	3,561	3,447	4,290	3,951	2,391	7,866	40,300	7,875	1,889	4,018	2,305
16	3,133	3,438	4,777	3,681	1,639	9,053	65,300	6,726	1,968	3,002	2,175
17	3,589	2,625	5,198	3,631	877	8,124	54,702	6,052	3,699	2,841	1,456
18	2,964	2,704	4,746	3,488	3,199	7,962	34,512	5,378	2,928	2,611	540
19	2,591	4,326	4,633	2,371	2,621	6,903	25,905	4,399	2,519	2,602	3,283
20	1,888	4,043	4,264	3,590	2,542	6,439	22,190	5,477	2,212	1,817	3,132
21	1,126	3,638	3,956	3,968	2,608	6,380	19,604	4,135	2,471	681	2,661
22	3,390	3,536	2,731	3,203	2,354	6,380	17,865	4,300	1,801	3,435	2,668
23	2,789	3,550	2,491	3,048	1,727	6,120	16,459	4,320	569	2,722	2,669
24	2,239	2,701	3,911	3,424	932	5,850	15,273	4,098	3,260	2,497	1,663
25	2,014	2,528	1,648	3,303	3,067	8,600	13,774	3,244	2,623	2,150	307
26	2,272	4,277	3,695	2,263	2,533	8,540	12,386	2,649	2,592	2,139	3,087
27	1,647	3,664	3,244	2,119	2,183	10,480	12,155	4,326	2,816	1,508	2,419
28	553	3,078	2,747	4,078	2,465	9,960	11,001	4,002	2,911	257	2,183
29	3,144	1,479	1,957	3,147	....	9,230	10,657	5,523	2,708	2,850	2,110
30	2,595	3,455	961	3,167	....	8,100	10,114	6,180	2,636	2,507	1,968
31	2,401	....	3,287	3,022	....	6,770	....	6,004	....	2,628	1,413

f Merrimack River at Lawrence, Mass., for the years ending t. 30, 1880–1915—Continued.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
17,500	2,810	12,820	22,500	8,040	5,720	2,280	1,454	2,277
21,600	2,160	65,400	24,300	7,050	4,870	2,122	610	2,000
14,680	4,420	82,150	24,150	5,820	5,020	1,979	2,796	1,859
11,250	3,250	45,200	21,250	6,750	4,580	305	2,579	1,681
7,000	3,040	26,400	15,540	5,400	3,840	358	2,382	1,319
5,960	2,720	20,100	15,060	6,900	2,865	2,944	2,223	620
6,960	13,580	19,900	14,200	6,600	1,856	2,540	2.451	2,398
7,600	26,900	15,620	13,620	6,030	3,930	2,443	1,617	5,004
6,000	27,000	17,600	12,860	5,060	3,420	2,295	1,641	5,919
6,480	22,200	13,910	13,020	4,700	3,160	2,462	3,209	4,900
5,960	17,300	13,460	13,700	5,420	5,250	1,741	3,043	3,841
5,460	13,670	11,820	13,600	4,420	6,250	763	2,369	2,754
7,140	12,220	10,610	17,100	4,740	4,390	2,928	2,509	2,640
5,800	10,460	10,400	21,000	4,560	3,360	2,366	2,535	4,323
5,600	9,400	9,000	27,400	4,250	4,650	2,208	1,551	3,076
5,380	7,655	10,030	26,400	3,310	3,900	2,217	438	3,444
4,920	8,420	8,100	28,100	2,895	3,750	2,098	2,954	3,334
4,100	7,690	9,720	30,100	4,560	3,690	1,426	2,388	2,975
3,335	7,140	9,640	27,900	2,970	3,690	203	2,178	2.076
5,500	7,360	14,460	25,100	2,880	2,610	2,166	1,990	2,486
4,480	7,180	24,100	23,000	3,410	1,820	2,057	1,990	4,685
3,820	6,260	27,000	20,900	3,530	3,700	2,077	1,232	4,656
4,090	4,900	25,100	18,200	2,680	3,410	2,451	183	4,577
3,840	6,030	21,350	14,970	1,920	2,450	2,757	2,846	3,661
4,190	6,460	17,750	13,500	3,850	2,410	2,053	2,375	3,292
3,550	6,780	15,040	10,230	2,850	2,430	1,378	2,165	2,090
4,870	6,140	17,400	10,600	2,600	1,850	3,278	2,129	2,014
4,400	5,655	20,100	9,920	3,200	1,080	2,581	2,107	4,117
4,410	5,360	18,500	9,680	3,480	2,950	2,375	1,502	2,936
3,530	....	19,900	9,120	3,320	2,635	2,237	275	2,705
3,540	....	20,100	....	4,380	....	2,212	2,854	....
2,807	3,776	3,963	14,238	9,957	9,153	5,642	9,220	3,074
1,943	2,931	3,636	14,616	10,049	8,090	7,037	8,574	3,467
2,180	2,775	3,669	15,348	10,908	7,394	6,497	7,539	3,840
4,009	2,740	4,780	15,908	11,538	7,673	5,470	6,576	2,438
4,000	2,730	5,943	16,067	12,514	9,028	5,010	6,352	2,547
4,816	1,902	6,944	18,116	11,949	10,517	5,454	6,877	2,864
6,707	2,390	8,042	21,048	10,727	10,469	4,805	6,374	4,460
7,325	5,779	10,500	22,974	9,443	9,068	4,725	5,027	2,854
5,285	7,946	9,385	22,611	7,829	8,397	4,969	5,164	2,685
4,032	9,427	9,125	24,513	7,613	15,264	3,803	4,551	2,760
5,005	9,094	10,100	24,483	6,582	40,872	3,393	4,575	2,072
3,990	7,589	12,300	21.510	7,714	35,923	4,841	5,043	1,424
3,313	6,214	13,680	17,953	8,840	26,829	3,370	5,006	3,736
3,364	4,821	13,350	16,235	14,051	21,473	16,921	4,280	2,934
2,989	5,429	11,243	15,873	24,681	19,643	32,498	3,729	2,644
2,026	4,759	10,365	18,789	19,306	17,539	41,499	4,983	2,684
1,834	4,539	8,904	23,407	14,171	14,996	26,568	4,073	2,658
4,030	4,343	8,472	23,271	11,448	12,675	16,903	4,159	1,930
3,231	4,392	8,092	20,629	9,481	11,416	13,672	4,721	1,044
3,104	8,398	9,216	18,710	8,301	9,217	11,173	4,522	3,717
2,965	3,467	11,156	17,085	7,607	10,348	9,853	2,860	3,020
3,025	4,847	13,373	14,605	6,657	10,297	9,137	3,169	2,804
2,357	4,306	13,627	13,078	5,752	9,375	8,650	5,118	2,768
2,322	3,812	16,735	12,203	6,313	7,931	9,098	3,520	2,446
,049	4,241	18,717	13,761	5,676	7,117	10,241	4,480	1,886
,997	4,036	17,871	15,884	6,716	6,877	12,121	5,467	1,370
,783	3,427	15,549	16,933	8,226	6,478	11,661	5,285	4,019
,771	2,869	12,944	15,214	9,060	6,376	10,466	3,996	3,087
,699	....	11,758	12,341	10,277	5,569	9,070	3,640	2,874
,994	....	11,498	10,947	10,626	5,246	9,782	5,007	2,671
,721	....	12,777	....	9,616	....	10,448	3,340	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years end Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Se
1897–98.												
1	2,647	2,374	5,150	4,751	5,000	10,050	19,795	16,279	9,964	3,853	3,575	3,
2	1,872	2,782	4,406	4,246	5,550	9,500	17,566	14,774	8,697	2,826	2,833	3,
3	440	4,666	4,246	8,200	5,100	9,240	15,026	13,387	7,771	2,623	2,617	2,
4	3,449	9,216	3,591	6,520	5,325	8,840	13,254	12,708	7,131	2,741	2,575	2,
5	2,757	7,604	3,216	5,790	5,250	8,350	12,195	12,535	7,124	4,516	2,624	2,
6	2,544	5,474	6,430	5,650	5,400	6,850	11,459	12,647	7,865	3,225	1,893	3,
7	2,570	3,897	8,992	5,380	6,150	8,800	11,004	12,630	7,163	2,721	1,969	3,
8	2,496	4,879	7,925	5,500	6,070	8,350	10,740	11,583	6,774	2,768	4,112	3,
9	1,534	3,741	6,598	5,260	5,600	8,940	10,128	11,144	6,585	2,015	3,056	3,
10	340	4,109	5,971	7,580	6,200	10,080	9,529	10,035	6,276	1,135	2,949	2,
11	2,542	5,680	5,172	6,520	6,150	11,380	9,742	8,452	5,619	3,805	3,563	1,
12	2,498	6,950	5,334	5,910	7,330	14,080	10,058	8,109	5,267	2,918	4,020	3,
13	2,582	8,033	8,124	6,040	7,320	17,600	10,386	8,552	5,706	2,707	3,221	2,
14	2,669	7,923	9,850	7,180	10,460	28,800	11,072	12,530	5,598	2,620	3,032	2,
15	2,428	7,441	15,100	8,170	10,120	36,000	11,507	11,834	6,832	2,533	4,744	2,
16	2,454	6,259	32,300	7,540	9,980	35,100	13,588	10,458	8,511	1,859	3,645	2,
17	1,892	6,231	36,800	9,700	8,400	30,000	17,111	9,959	7,213	1,018	3,412	1,
18	3,805	6,909	28,504	7,770	7,750	26,100	17,021	9,505	5,205	3,551	3,115	
19	2,770	7,378	20,203	6,790	8,460	25,200	15,048	8,858	4,506	2,517	3,337	2,
20	2,716	6,019	14,157	6,040	6,850	25,000	14,330	8,307	5,923	2,568	3,359	2,
21	2,502	4,801	12,113	7,300	9,080	27,600	13,717	7,472	7,026	2,581	5,459	2,
22	2,390	5,331	10,563	9,340	9,270	30,200	13,493	7,302	7,908	2,920	6,261	2,
23	1,525	4,960	10,878	9,140	9,930	25,800	12,121	7,404	6,694	2,360	5,469	2,
24	398	4,851	9,169	11,480	10,430	22,300	13,666	6,160	6,590	2,327	4,439	1,
25	3,096	3,022	9,170	11,100	10,790	21,800	25,342	7,316	5,790	3,919	4,892	1,
26	2,566	5,424	7,065	10,500	10,740	20,000	30,362	10,501	5,142	2,851	5,403	6,
27	2,341	4,390	7,633	9,450	8,900	17,000	27,394	14,041	5,458	2,724	4,913	5,
28	2,506	7,816	6,116	8,960	10,700	17,900	22,139	15,785	5,110	2,709	4,527	4,
29	2,268	9,714	5,831	8,040	....	18,000	19,424	15,081	4,567	2,713	5,306	4,
30	1,648	6,924	5,653	6,620	....	18,400	18,612	13,713	3,908	1,753	3,806	3,
31	176	....	5,410	6,750	....	19,700	....	11,811	....	1,081	3,657	....
1898–99.												
1	2,455	8,384	9,778	5,661	5,145	7,360	16,700	22,870	4,277	2,019	2,925	2,
2	2,077	7,759	9,856	6,511	4,919	7,810	14,840	23,647	3,907	387	2,370	1,
3	3,951	7,157	9,141	6,004	4,841	7,379	15,160	23,410	3,231	2,131	2,423	
4	3,034	6,525	8,271	6,643	3,659	6,837	14,590	23,158	2,701	1,500	2,659	1,
5	3,055	5,871	11,050	7,863	3,531	6,992	14,680	18,876	4,292	3,691	1,806	3,
6	3,761	5,204	16,808	10,816	5,458	10,630	15,190	15,125	3,601	2,770	749	3,
7	5,827	6,114	17,398	11,519	4,240	13,059	16,400	12,428	3,065	2,927	3,604	2,
8	5,759	5,477	15,190	10,373	4,501	12,859	18,400	11,694	2,944	2,044	2,784	2,
9	5,393	5,319	12,245	10,024	4,087	11,968	25,000	10,618	3,214	570	2,186	1,
10	6,080	5,617	9,637	8,747	4,308	10,628	29,200	9,652	2,450	3,984	2,248	
11	4,897	9,353	8,591	7,572	3,344	9,194	29,400	8,827	1,981	3,346	2,635	2,
12	4,667	15,304	8,855	6,831	3,075	9,161	28,200	8,564	3,806	2,996	1,886	2,
13	4,484	14,746	6,699	6,358	4,731	13,795	26,000	7,706	3,076	3,176	372	2,
14	4,043	12,781	6,330	5,611	3,576	18,900	25,600	7,131	2,731	2,948	3,123	2,
15	3,367	10,971	6,532	6,126	3,740	18,600	30,000	7,440	2,457	2,055	2,768	2,
16	4,361	9,784	6,715	8,214	3,845	17,500	34,400	6,376	2,857	685	2,196	1,
17	6,023	8,962	6,279	9,681	3,933	15,200	38,200	6,422	2,317	3,678	2,125	
18	5,325	8,622	5,908	11,329	3,617	15,000	35,527	5,932	2,481	2,810	2,468	1,
19	4,982	9,810	6,841	10,799	4,092	12,330	33,498	5,650	4,430	2,851	1,857	1,
20	5,055	15,303	6,378	9,211	5,747	12,920	34,623	5,213	2,866	2,476	355	1,
21	6,075	19,785	6,144	7,823	5,749	12,040	34,310	5,468	2,894	2,488	2,098	2,
22	7,421	17,553	6,084	6,839	6,083	12,210	30,583	6,800	3,101	1,706	2,257	2,
23	10,178	14,351	6,876	7,317	6,550	11,500	27,846	5,897	2,865	525	2,187	1,
24	11,583	11,625	9,007	6,713	7,098	11,340	29,483	5,654	2,066	3,808	2,123	
25	9,962	11,699	10,290	7,396	6,885	11,260	31,656	4,909	1,134	2,905	2,136	2,
26	8,307	11,113	9,534	8,291	6,309	9,400	31,367	4,823	3,582	2,893	1,674	2,
27	8,909	9,627	8,892	8,192	6,988	11,130	31,157	4,022	2,883	2,599	78	2,
28	13,699	6,872	8,425	6,870	6,637	10,360	30,816	3,543	2,841	2,949	2,067	2,
29	14,473	6,253	6,572	5,906	....	11,240	26,805	5,255	2,506	2,241	2,153	2,
30	10,534	8,677	6,024	6,808	....	14,600	23,507	3,862	2,846	1,984	2,222	1,
31	9,565	....	5,792	5,504	....	17,200	....	4,383	....	3,781	2,132	....

of Merrimack River at Lawrence, Mass., for the years ending pt. 30, 1880-1915—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
7	3,230	4,631	17,350	11,129	10,674	5,332	479	2,134	1,389
1	2,696	4,408	33,802	12,507	11,597	4,356	2,653	2,192	417
4	2,471	2,871	37,732	13,412	11,485	4,397	2,370	2,338	284
9	1,860	2,468	33,090	15,389	12,887	6,520	311	1,505	2,340
4	1,902	5,520	26,893	16,797	15,881	7,492	2,226	113	2,206
3	1,209	5,687	20,329	17,602	13,228	7,616	2,369	2,038	2,099
8	82	5,910	17,011	19,458	11,654	6,491	1,696	1,694	1,912
7	2,649	5,933	14,368	21,184	10,332	5,721	350	1,771	1,252
3	2,561	7,112	13,356	21,511	9,817	4,178	2,471	1,860	90
5	2,220	9,550	13,067	18,308	9,661	3,873	2,372	1,939	1,901
	2,182	9,060	12,211	15,157	10,324	5,275	2,315	1,347	1,637
	2,327	9,930	11,403	13,660	8,880	3,899	2,339	100	1,540
	1,463	12,720	11,067	14,497	7,629	3,701	2,270	2,562	1,626
	266	47,000	10,875	14,557	7,972	3,702	1,629	2,461	1,428
	2,654	52,969	8,984	13,646	7,001	3,811	186	2,218	732
	2,574	41,745	10,684	14,643	8,313	2,705	2,022	2,354	37
	2,269	28,923	13,364	15,945	10,062	2,800	2,206	2,483	1,673
	2,335	19,311	14,243	17,886	8,772	4,368	2,228	1,986	2,156
	2,394	13,731	14,536	22,372	7,885	3,528	2,299	1,372	2,242
	1,893	12,947	16,437	29,896	11,519	2,940	2,283	3,541	2,202
	2,041	11,549	20,324	34,926	18,169	2,931	1,483	2,469	1,977
	6,810	12,317	19,517	30,809	15,538	3,062	146	2,229	1,245
	7,950	19,300	16,729	27,402	12,433	2,233	2,125	2,072	36
	8,184	20,400	14,555	24,627	10,344	1,487	2,365	2,072	2,175
	7,234	24,772	12,680	23,144	9,196	3,915	2,133	1,433	2,385
	6,027	27,591	12,449	20,338	7,867	2,967	2,159	296	2,229
	4,401	23,911	11,429	16,730	6,824	2,732	2,189	1,754	2,209
	3,891	19,187	11,065	14,422	7,271	2,377	1,641	2,030	2,159
	6,291	....	11,264	11,727	6,455	2,448	242	1,958	1,498
	5,323	....	11,290	11,326	5,109	1,825	2,487	1,889	309
	4,776	....	11,484	....	6,272	....	2,317	1,956	....
	4,628	2,888	2,360	14,060	16,296	19,479	4,048	4,869	2,010
	4,574	2,191	1,792	12,510	15,547	16,315	2,881	4,577	2,481
	4,284	1,630	745	12,580	15,222	15,139	2,694	3,212	4,093
	3,850	3,919	3,189	18,100	14,601	13,616	603	2,424	3,507
	2,343	3,007	2,851	31,650	12,554	12,666	2,633	4,404	2,926
	2,192	2,957	2,991	34,200	11,766	11,270	2,586	3,016	2,916
	4,462	2,526	2,906	33,950	10,749	9,972	2,403	2,951	1,831
	3,210	2,531	2,897	61,200	9,831	9,470	3,905	4,722	1,467
	2,872	1,916	2,116	62,511	8,815	9,653	3,260	11,252	4,086
	3,284	640	1,851	48,756	9,053	10,520	3,083	8,627	2,879
	3,796	3,356	4,591	38,023	10,048	9,175	3,522	6,705	2,951
	2,595	2,726	12,620	31,463	13,099	7,948	3,913	6,982	2,356
	2,259	2,510	14,060	26,155	15,886	7,024	2,416	5,592	2,519
	1,480	2,667	11,920	22,319	14,640	6,571	2,405	4,790	1,599
	3,402	2,516	9,600	20,832	13,081	5,519	4,315	4,358	1,749
	,359	1,846	7,870	19,528	11,072	4,746	3,080	3,941	3,764
	,626	889	5,660	17,686	9,684	5,777	2,907	2,928	3,133
	,757	3,312	7,690	16,317	8,362	4,808	2,832	3,965	3,182
	,712	2,850	6,110	15,627	9,095	4,220	2,959	4,864	1,450
	,348	2,785	5,980	15,010	19,104	3,916	2,292	3,619	4,232
	,641	2,712	5,770	13,764	28,185	4,186	2,455	3,396	2,602
	,408	2,803	12,390	16,027	27,308	3,286	4,055	3,078	1,790
	,462	1,929	15,210	21,961	21,863	3,520	3,185	3,017	4,004
	,388	560	13,420	26,279	18,063	4,987	2,754	1,968	2,963
	,363	3,272	14,110	28,294	16,986	4,382	2,802	3,185	2,615
	415	2,857	13,650	31,770	17,300	4,119	2,753	5,422	2,525
	265	2,476	20,800	29,915	17,588	4,238	1,779	5,132	2,641
	303	2,394	26,350	23,868	18,588	4,013	629	4,721	1,759
	392	....	26,300	19,629	23,391	2,850	3,755	4,223	300
	075	....	21,600	16,732	23,766	2,239	3,193	3,659	3,367
	070	....	15,400	....	22,417	....	3,522	2,308	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years end Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1901–2.											
1	2,929	3,150	2,435	26,500	7,638	22,629	28,212	19,442	7,914	4,069	3,755
2	2,508	2,186	4,630	22,250	7,471	51,985	24,483	25,470	7,499	4,422	2,057
3	2,703	2,070	3,294	16,650	9,057	59,880	20,272	20,161	6,408	3,974	2,052
4	3,012	4,259	3,287	13,090	8,605	61,185	17,209	15,792	5,978	4,465	4,125
5	1,635	3,168	2,882	11,189	8,313	44,377	14,803	14,881	5,764	7,016	3,170
6	1,087	3,119	2,754	9,652	7,315	28.452	12,842	14,091	5,476	6,569	2,842
7	3,626	2,931	2,065	7,856	6,398	21,990	12,015	13,870	4,376	5,650	2,889
8	2,818	3,048	1,333	8,130	5,124	19,471	11,374	12,816	3,828	4,937	2,957
9	2,682	1,936	4,103	7,623	4,947	17,656	15,265	12,424	5,249	4,532	2,235
10	2,686	1,460	3,628	6,985	5,981	18,624	32,204	10,881	4,697	3,841	2,226
11	2,557	3,952	4,187	6,130	5,287	18,834	39,195	9,104	5,179	3,973	4,540
12	1,731	2,878	5,111	5,737	5,098	18,973	35,563	9,162	4,663	2,618	5,371
13	607	2,618	6,865	6,856	4,862	23,909	27,127	7,858	3,856	2,881	8,544
14	3,595	2,827	6,447	5,387	4,635	33,547	22,988	7,690	3,732	4,503	7,500
15	6,149	3,697	9,440	5,247	3,502	34,170	19,045	6,799	3,373	3,146	6,082
16	13,374	2,615	34,100	5,646	3,591	28,373	16,452	6,486	5,009	3,026	4,351
17	11,552	2,361	41,500	5,701	4,987	26,745	14,485	5,591	4,297	3,493	3,362
18	8,484	4,972	24,200	5,069	4,180	34,954	13,602	4,814	6,974	3,654	4,806
19	6,509	3,127	15,690	4,924	4,009	34,583	12,194	6,008	7,067	2,490	3,266
20	5,038	3,138	12,580	5,821	4,194	26,041	11,090	5,260	5,850	2,595	3,123
21	5,785	3,274	10,390	5,217	4,120	22,375	11.580	5,444	4,434	4,732	3,066
22	4,575	3,478	7,100	6,735	2,995	22,754	10,922	5,405	4,118	4,475	3,247
23	4,421	2,164	7,370	15,405	3,075	23,191	10,713	5,139	5,644	5,511	2,638
24	3,908	1,661	6,370	21,308	4,835	23,697	10,737	4,224	5,487	5,976	4,052
25	4,239	4,785	6,750	18,738	3,801	21,764	10,966	4,238	5,077	6,120	5,653
26	2,805	3,996	9,220	14,659	4,113	19,186	10,138	6,239	4,363	4,977	4,534
27	2,659	3,893	7,760	13,144	6,870	17,877	11,369	7,018	4.674	4,021	3.944
28	4,527	1,461	7,722	12,472	12,369	16.966	16,672	10,379	6,680	5,015	3,631
29	3,525	4,511	7,568	11,416	....	15,766	15,144	13.962	5,347	3,955	2,906
30	3,200	2,765	15,858	9,689	....	22,711	13,106	14,080	5,762	3,887	2,183
31	3,054	....	25,800	8,851	....	31,751	....	10,466	....	3,627	1,551
1902–3.											
1	9,696	12,377	5,362	8,473	9,033	26,761	25,268	6,748	2,005	7,708	3,652
2	9,021	9,338	4,873	8,298	10,077	30,045	25,675	6,971	1.637	7,304	3,011
3	7,985	9,053	4,569	7,877	9,401	27,928	22,025	6,212	1,541	6.891	4,639
4	6,477	7,943	5,455	8,850	9,689	22,588	20,112	6,132	2,540	5,248	3,243
5	5,296	7,179	6,115	11,264	11,622	19,177	20,008	5,905	2,701	4,718	3,332
6	6,640	6,538	4,782	11,137	12,443	17,744	21,321	6,042	1 773	5,591	3,542
7	7,766	6,421	3,481	10,448	11,056	15,694	18,395	6,071	562	4,742	4,267
8	8,643	5,486	5,395	9,586	9,123	15,260	17,323	5,901	3,622	3,836	3,842
9	7,849	5,200	4,239	8,630	8,309	22,311	19,760	5,575	2,804	4,419	3,286
10	6,242	6,443	4,422	7,096	7,876	32,304	21,866	5,008	2,729	4,392	4,834
11	4,884	5,195	4,155	6,449	8,040	37,542	20,907	4,505	2,741	2,822	3,318
12	4,327	5,161	4,168	7,355	9,279	43,867	17,917	4,973	2,940	2,447	3,276
13	6,258	5,203	3,409	6,420	12,856	45,469	16,515	5,001	3,579	4,371	3,295
14	6,370	5,295	3,542	6,776	13,930	39,851	15,341	4,877	11,930	3,439	3,852
15	5,899	5,385	5,354	7,136	12,752	32,205	14,362	4,677	16,400	3,200	3,166
16	5,477	5,114	4,234	7,179	11,861	29,438	15,634	4,324	15,400	3,519	2,242
17	5,061	6,106	4,811	6,379	9,919	25,507	17,833	3,770	17,200	3,126	4,127
18	4,006	5,251	8,820	5,645	8,461	22,441	17,242	4,404	14,200	2,131	2,939
19	3,502	5,185	12,509	6,549	8,209	21,163	14,702	3,902	11,520	2,266	2,824
20	5,263	4,976	11,628	5,954	8,095	20,566	13,556	3,910	9,410	4,470	2,667
21	5,286	4,787	9,860	5,930	7,365	23,260	12,600	3,804	7,890	3,877	2,668
22	6,358	4,342	11,812	7,257	7,038	28,051	11,533	3,656	24,400	5,641	2,350
23	5,831	3,857	17,858	8,590	7,890	31,840	10,258	3,168	35,600	7,856	2,847
24	5,178	5,234	19,966	8,187	7,245	37,098	10,220	2,407	28,384	7,270	4,220
25	4,203	4,491	16,553	7,965	7,192	39,050	9,453	3,373	21,521	6,530	3,108
26	3,510	4,431	14,345	8,026	7,024	37,107	8,331	3,312	18,112	5,082	3,054
27	5,320	2,935	11,940	7,064	6,896	29,868	8,469	2,487	14,994	5,526	3,417
28	5,087	5,614	10,307	6,662	7,964	23,361	7,221	2,705	11,757	4,194	3,477
29	15,154	4,065	9,968	6,672	....	20,328	6,951	2,788	10,296	3,951	2,373
30	22,253	3,831	8,707	7,125	....	19,778	6,815	2,054	8,659	3,846	2,327
31	17,176	....	9,063	7,705	....	20,322	....	653	....	3,668	4,293

f *Merrimack River at Lawrence, Mass., for the years ending t. 30, 1880-1915*—Continued.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
2,825	4,039	4,034	17,994	46,336	6,252	3,236	3,230	2,271
2,265	3,115	3,828	21,175	38,498	5,241	3,516	2,681	2,254
1,901	3,041	3,949	23,976	29,795	6,233	5,193	2,321	1,643
4,265	2,854	4,274	22,677	22,895	5,574	4,586	2,651	393
2,796	2,812	3,667	19,056	20,321	5,431	5,174	2,647	409
2,753	2,109	4,373	17,218	18,408	6,292	4,575	1,799	3,378
2,644	1,242	6,085	17,726	16,477	6,583	3,795	327	2,844
2,724	3,801	6,730	19,432	13,731	8,287	3,340	3,163	2,370
1,904	3,152	10,627	20,738	13,193	8,368	2,496	2,850	2,301
1,298	2,896	13,740	28,174	13,244	7,520	2,302	2,620	1,546
3,852	2,869	14,711	36,984	14,560	6,298	4,225	2,382	358
2,901	2,813	13,406	33,942	17,567	5,269	2,881	2,529	2,303
2,878	1,852	11,664	27,748	17,469	5,921	2,783	1,578	2,275
2,798	1,017	10,881	22,937	13,795	5,115	2,716	288	2,295
3,059	3,728	9,728	19,028	11,340	4,465	2,713	3,065	2,586
2,095	2,965	8,831	16,369	11,657	4,175	1,667	2,850	3,396
1,613	2,873	7,883	14,613	15,507	3,921	928	2,445	7,983
3,936	2,660	7,353	14,544	19,890	2,748	3,758	2,549	5,595
3,042	2,737	6,668	14,624	16,912	2,862	2,714	2,495	5,526
2,769	1,909	6,817	15,183	21,331	4,193	2,662	1,550	4,423
2,920	899	8,714	14,449	27,354	3,592	2,638	393	3,397
2,820	3,679	9,198	14,355	22,002	2,914	2,403	5,267	3,156
1,753	3,364	9,500	13,300	17,542	2,911	1,384	5,819	3,121
1,062	3,394	11,360	12,254	14,211	2,946	367	4,494	2,003
3,621	3,592	14,370	12,684	11,326	1,918	2,601	3,468	1,601
2,869	4,129	23,479	13,620	10,999	1,805	2,680	3,489	3,942
2,832	3,392	35,149	15,139	10,508	4,002	2,397	1,927	3,142
2,875	3,397	36,205	20,584	9,431	3,024	2,485	767	3,887
2,914	5,043	31,579	35,300	8,496	3,017	2,579	3,487	3,504
2,241	....	23,650	45,300	7,704	3,132	1,661	2,402	3,486
1,681	....	19,408	....	7,721	....	260	2,298	....
453	2,838	2,526	44,887	7,434	3,414	3,585	2,477	2,713
,147	2,784	2,695	37,260	6,537	3,015	2,941	4,775	2,109
,084	2,760	2,527	28,553	6,379	1,958	2,938	4,676	3,109
,981	1,990	1,514	22,206	6,002	1,470	4,897	3,939	6,430
,812	457	430	18,850	5,868	3,708	6,028	2,591	20,900
,735	3,505	2,768	19,442	6,094	3,116	4,508	1,632	17,434
,662	2,865	2,567	25,546	5,732	2,987	3,881	3,631	12,978
,358	2,518	2,596	25,097	6,548	3,070	2,321	2,955	9,854
,710	2,440	2,774	20,156	6,806	3,710	1,907	2,443	7,257
,930	2,695	2,811	16,880	6,174	2,993	3,947	2,390	5,541
844	1,902	2,418	15,309	5,619	2,482	3,148	2,441	5,953
470	489	2,305	17,546	5,303	4,330	2,836	1,454	4,960
301	3,094	4,898	19,451	4,150	3,427	2,807	474	5,035
862	2,613	3,879	18,502	3,905	3,033	2,826	5,031	7,285
377	2,573	3,842	16,148	5,467	3,930	1,764	2,953	7,330
111	2,510	4,020	14,215	3,758	4,296	581	2,697	5,525
352	2,678	4,034	12,661	6,010	2,599	3,637	2,980	4,309
893	1,825	2,977	11,273	6,938	2,348	2,759	3,257	5,171
20	456	4,050	9,761	6,716	4,410	2,723	2,987	8,525
86	2,940	11,100	8,546	6,211	3,617	2,404	2,141	17,529
94	2,691	11,210	7,961	5,208	4,253	2,538	3,690	13,968
87	2,521	10,500	8,018	5,653	5,768	1,677	2,739	11,540
41	2,464	9,150	10,857	4,564	8,238	383	2,729	9,007
45	2,574	8,800	10,793	4,520	7,433	2,603	2,505	6,588
43	1,666	8,740	9,115	4,178	5,593	2,559	2,766	6,467
55	410	11,570	8,094	3,947	5,918	2,382	1,481	5,262
31	2,850	32,003	7,698	2,866	4,987	2,376	316	4,721
27	2,514	36,429	7,225	2,812	5,912	2,343	2,344	4,488
95	....	41,219	6,856	4,343	7,300	1,403	2,458	4,133
96	....	45,940	6,639	2,769	5,615	128	2,374	2,830
37	....	45,617	....	3,171	....	2,079	2,445	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years end Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1905-6.											
1	2,733	3,240	5,043	7,791	6,484	7,473	15,770	7,945	20,079	6,426	5,374
2	4,371	2,796	3,984	6,896	6,201	6,268	15,330	8,162	15,347	9,087	7,314
3	3,276	2,818	3,714	6.152	4,087	5,698	13,070	8,359	12,957	8,739	5,357
4	3,190	1,813	8,930	5,827	3,692	8,095	11,970	8.641	12,471	7,183	4,339
5	3,214	1,439	15,540	6,091	5,227	12,552	11.950	9,198	10,974	8,890	4,044
6	3.336	4,850	12,350	6,175	3,693	14,218	13,940	7,998	9,410	8,980	5,335
7	2.390	4,409	9,354	5,923	4,062	11,207	17,000	9,276	9,015	7,386	4,468
8	2,103	5,345	7,933	6,595	3.753	9,714	14,290	8,735	11,016	5,663	3,945
9	4,179	5,559	6,009	5,551	3,734	8,499	13,940	8,277	11,419	5,945	3,969
10	3,238	5,251	5,483	5,042	2,301	7,765	13,840	7,965	10,575	5,125	3,643
11	3,065	3,907	6,016	4,560	2,158	7,313	14,800	9.914	10,623	4,729	2,251
12	2,544	3,513	4,087	4,283	4,978	8,534	17,900	9,501	9,212	4,614	1,986
13	2.812	5,062	4,099	3,013	3,803	7,052	19,400	7,803	8,018	4,596	4,435
14	3.116	3,679	4,338	3,800	3.681	6,352	19.200	8,312	6,897	3.361	3.327
15	3,589	3,552	4,429	5,578	3,761	5,020	17,600	8,974	6,352	2,825	2,877
16	4.620	3,732	2,838	5,025	3,503	4,542	25,800	7,852	4,720	4,548	2,946
17	3,684	3,654	2,286	6,174	2,345	3,436	35,400	6,797	5,283	3,229	2,850
18	3,311	2,289	4,622	7,148	2,497	4,322	29,298	6,863	12,608	3,102	1,995
19	3,381	2,461	3,460	6,781	4,921	5,416	22,112	7,087	15,349	3,649	839
20	3,396	4,397	3,371	5,587	3,663	4,424	19,839	6,783	13,500	4,137	3,641
21	2,297	3,537	3,997	4,958	3,680	4,301	17,289	7,014	10,995	3,522	2,945
22	2,886	3,256	4,664	6,467	5,161	4,482	15,786	5,637	9,087	3,318	2,734
23	4,760	3,129	5,211	7,437	8,029	4,851	16,601	4,715	7,374	4,701	2,571
24	3,764	2,892	5,837	13,845	9,200	3,030	14,856	4,818	7,361	3,796	2,709
25	3,526	1,827	5,638	23,900	7,210	3,219	12,634	4,588	10,934	4,456	1,581
26	3,447	1,193	6,460	19,804	9,980	5,317	10,785	4,451	11,674	4,285	753
27	3,376	4,118	5,505	13,643	11,131	4,410	9,749	6,184	9,747	3,932	3,456
28	2,090	3,307	4,900	10,626	10,085	7,508	8,474	12,300	8,050	2,620	2,804
29	1,851	3,212	4,890	9,629	....	17,100	7,621	35,650	9,779	2,599	2,596
30	4,119	1,413	4,881	6,770	....	18,600	8,537	36,910	5,595	4,602	2,619
31	3,418	....	6,432	6,403	....	17,500	....	27,639	....	3,604	3,040
1906-7.											
1	2,288	3,344	2,397	4,474	3,476	3,025	27,271	14,731	4,299	4,552	2,806
2	2.379	3,157	1,776	6,962	2,214	2,269	22,680	17,411	4,913	4,526	2,921
3	2.237	2,126	4,441	7,174	2,598	504	17,667	15,068	6,283	5,129	1,815
4	2,206	452	3,395	8,817	4,901	3,591	14,800	11,149	7,516	3,509	341
5	2,266	3,438	2,644	14,850	3,806	3,214	13,304	10,130	9,369	4,456	3,264
6	1,514	3,352	2,622	15,038	3,303	3,011	13,019	10,904	9,433	2,999	3,092
7	132	3,246	2,505	14,821	3,194	3,010	13,038	9,952	10,599	2,634	2,989
8	1,977	2,686	1,654	13,409	3,467	3,034	12,588	9,392	10,557	4,640	2,770
9	1,936	2,460	366	10,793	2,326	2,282	11,388	9,113	8,763	3,812	2,850
10	2,155	1,652	2,900	7,720	1,273	647	10,062	8,929	8,402	3,738	1,881
11	2,652	334	3,054	6,865	4,640	4,056	9,855	8,283	7,252	3,493	332
12	2,723	2,851	2,816	5,453	3,477	3,304	10,112	8,199	6,689	3,338	2,950
13	1,574	2,842	2,901	5,004	3,218	3,046	10,996	8,462	6,241	2,225	2,764
14	662	3,270	2,777	6,409	3,172	2,920	11,558	7,529	5,651	3,032	2,690
15	3,508	3,285	1,903	4,866	3,330	3,247	12,506	6,726	4,069	5,028	2,502
16	3,127	3,636	487	4,639	2,299	2,704	12,646	7,950	4,139	4,158	2,281
17	3,011	2,406	3,564	4,533	1,136	4,927	12,357	8.665	5,642	3,459	1,473
18	2.540	941	3,066	4,094	4,550	9,430	11,748	13.348	4,147	3,311	132
19	2,471	4,121	3,120	2,446	3,504	10,940	10,939	12,214	3,622	3,181	1,830
20	1,497	3,405	2,910	2,695	3,105	10,940	10,061	10,763	3,553	2,518	1,857
21	133	4,995	3,002	5,911	3,132	9,640	9,098	9,384	3,476	456	2,014
22	2,525	5,048	2,031	5,373	3,304	10,671	9,333	8,185	2,250	3,949	2,141
23	2.850	5,269	478	5,013	2,308	11,243	7,815	7,360	1,965	3,129	2,348
24	3,337	4,072	4,223	4,774	583	14,784	8.640	6,561	4,652	3,121	1,235
25	3,186	3,518	850	4,345	4,346	15,302	13,802	5,180	3,517	3,024	363
26	3,201	5,094	3,999	2,747	3,324	14,043	17,572	4,929	3,246	2,735	1,664
27	2,671	4,011	3,271	2,496	2,799	13,337	14,134	6,311	3,191	2,067	1,356
28	3,449	3,629	3,289	5,566	2,734	13,364	15,465	7,011	3,241	1,021	1,262
29	4,738	1,559	2,239	3,838	....	15,504	15,533	6,565	2,044	4,030	1,290
30	3,648	4,823	551	3,634	....	19.465	14,232	6,173	1,815	3,214	1,321
31	3,398	....	4,054	3,647	....	24,309	....	6,253	....	3,086	1,214

t, of Merrimack River at Lawrence, Mass., for the years ending Sept. 30, 1880-1915—Continued.

Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
,717	14,082	4,787	6,039	19,608	14,835	11,442	2,821	1,172	2,670
,150	12,632	4,708	6,712	16,676	16,159	12,045	2,772	177	2,592
,225	10,945	6,421	6,635	14,666	16,624	9,640	2,253	2,800	2,544
,936	8,580	5,002	6,252	12,562	15,990	7,763	370	2,778	2,253
,778	7,370	4,348	5,977	10,021	14,592	6,378	576	2,713	1,401
,191	7,449	4,198	5,699	9,832	14,430	5,211	3,380	3,032	417
,546	6,975	3,508	5,479	9,823	12,248	4,716	2,760	5,079	397
,601	9,520	3,033	5,658	11,038	13,013	5,734	2,684	6,571	2,926
,025	12,691	3,639	7,361	12,693	18,391	5,323	2,693	4,898	2,947
,802	11,720	5,148	6,312	12,615	18,817	3,230	2,418	5,008	2,749
993	9,946	4,031	6,264	12,312	17,833	4,010	1,574	4,089	2,184
387	9,399	3,902	5,957	12,445	15,230	3,720	285	3,697	1,413
880	13,389	3,788	7,065	13,046	13,352	2,637	1,976	3,461	138
899	15,579	3,520	9,091	11,438	12,643	2,686	2,063	3,526	2,240
314	12,924	5,846	10,558	10,140	13,084	4,389	2,255	2,985	2,277
74	11,267	17,905	15,654	9,768	13,008	3,379	2,513	2,333	2,254
95	8,869	22,895	19,604	10,561	11,345	3,047	2,048	3,690	2,181
65	8,251	21,019	17,322	10,094	10,527	2,796	1,191	3,385	1,982
21	7,525	15,069	14,299	9,436	9,673	3,277	80	2,862	1,380
24	7,525	10,539	11,600	10,418	8,858	1,743	2,116	2,678	70
55	6,347	9,137	9,862	11,287	8,235	818	2,718	2,555	1,658
91	6,650	7,977	8,822	10,031	7,564	2,711	4,018	1,866	1,541
74	6,404	7,122	9,071	8,794	7,838	2,708	4,177	1,891	1,545
57	5,364	7,437	10,783	8,482	8,453	2,784	3,102	3,826	1,529
56	4,668	6,275	17,382	9,366	9,074	2,693	1,889	2,812	1,523
7	5,253	5,879	18,211	10,650	7,789	2,493	1,815	2,762	852
5	6,658	6,647	16,612	12,513	6,897	1,653	3,946	2,771	73
3	6,537	6,844	18,540	14,798	6,063	499	3,332	2,731	1,511
3	7,235	6,511	19,578	15,888	5,414	3,401	2,876	1,560	1,674
8	6,568	....	22,530	18,024	4,832	2,866	2,946	388	1,870
5	5,221	....	22,470	....	6,010	....	2,538	2,465	....
9	2,171	3,897	11,354	10,029	11,568	5,869	2,666	97	1,270
2	1,470	2,868	9,658	9,851	11,570	4,852	2,746	2,239	1,401
	309	2,820	8,761	9,381	12,935	4,649	1,664	2,164	1,960
	2,057	2,773	8,230	8,620	12,216	4,438	328	2,108	1,257
	1,771	2,626	7,292	9,164	11,125	2,627	522	2,213	135
	2,345	1,878	5,514	10,239	11,212	3,108	3,596	2,404	581
	4,045	1,739	5,266	12,774	10,583	6,386	2,928	1,271	2,379
	8,704	4,763	7,023	16,622	10,432	6,753	2,771	121	1,960
	6,312	4,328	5,608	19,402	10,196	5,822	2,924	2,198	2,317
	4,381	4,924	5,141	15,813	10,897	5,220	2,065	2,200	2,356
	5,301	6,016	7,821	10,740	11,010	4,720	216	2,092	1,399
	4,327	6,287	5,573	8,831	11,530	3,936	2,371	1,988	150
	3,710	5,768	5,335	7,370	10,482	3,518	2,366	2,025	1,839
	3,584	5,125	5,517	7,945	8,591	5,117	2,392	1,179	1,893
	3,435	6,153	6,696	18,503	7,227	3,779	2,266	126	1,998
	2,331	5,369	4,650	34,505	6,803	3,674	2,283	1,903	2,210
	609	4,627	5,932	34,929	7,666	3,665	1,408	1,827	2,213
	3,106	4,154	5,682	26,077	9,304	3,626	99	2,120	1,337
	2,633	4,363	5,199	21,554	9,721	3,716	2,292	2,327	139
	2,527	4,335	3,788	19,239	9,210	6,239	2,347	2,132	1,889
	2,575	7,666	4,500	21,389	8,661	6,053	2,390	1,121	1,718
	2,595	13,970	6,140	18,690	7,672	4,489	2,409	130	1,749
	2,038	14,370	5,163	17,116	6,506	4,300	2,341	2,006	1,729
	894	14,500	5,270	16,553	7,040	3,914	1,470	2,134	1,753
	,952	18,150	6,293	13,920	6,276	3,592	116	2,241	1,271
	,340	18,080	14,949	12,884	5,536	2,287	2,388	2,282	167
	,182	15,295	17,542	11,551	5,431	1,464	2,450	2,543	1,894
	,186	12,460	14,198	11,240	5,114	4,074	2,421	1,456	2,056
	,275	....	12,987	12,112	4,497	3,062	2,322	283	2,438
	,228	....	11,469	12,400	5,352	2,448	2,160	1,737	4,101
	,374	....	10,719	....	6,132	....	1,252	1,486	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years endin Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1909–10.												
1	4,857	2,010	2,832	1,233	6,244	16,620	18,030	11,887	3,808	2,466	2,573	1,70
2	2,746	2,002	2,610	115	5,784	25,300	16,096	11,641	4,307	1,557	2,296	1,85
3	1,656	2,091	2,777	1,929	5,329	28,420	14,154	10,422	5,597	1,364	2,101	1,05
4	3,676	2,190	2,028	1,975	5,016	25,750	13,412	9,909	4,480	1,770	2,148	12
5	2,313	2,227	393	1,829	3,034	24,730	11,799	10,374	3,417	2,841	2,374	22
6	2,151	1,454	2,682	1,669	2,996	21,774	11,266	10,966	4,898	2,129	2,080	2,37
7	2,056	212	2,671	2,145	4,880	21,182	12,915	9,630	3,757	2,119	3,103	2,10
8	2,221	2,001	2,657	1,761	3,771	21,677	13,361	7,880	4,832	2,059	3,531	2,30
9	1,507	2,072	2,442	257	4,014	21,685	11,618	7,904	5,862	1,425	2,543	3,22
10	101	1,965	2,606	2,481	4,205	18,476	9,586	7,413	5,496	1,085	2,060	2,25
11	1,914	1,944	1,738	2,511	4,225	16,030	9,020	7,167	4,684	3,139	2,173	1,48
12	2,046	1,893	253	2,485	2,730	13,427	7,777	6,928	5,310	2,450	2,191	2,81
13	2,159	1,341	2,451	2,520	2,696	11,990	7,015	6,378	7,815	2,364	1,597	2,49
14	2,040	143	2,737	2,665	4,931	12,531	6,070	5,282	8,036	2,279	358	2,31
15	2,124	1,750	3,263	1,753	4,091	12,052	5,406	4,853	7,228	2,316	2,613	2,11
16	1,668	1,731	3,441	395	3,689	11,468	5,056	5,970	6,005	1,511	2,617	1,94
17	125	1,859	3,665	3,032	3,712	10,727	4,871	5,175	5,307	128	2,140	1,16
18	2,011	1,870	2,256	2,817	4,100	11,661	5,958	4,767	5,009	1,916	2,171	16
19	1,855	1,882	666	2,756	2,783	10,965	5,170	4,941	5,674	1,956	2,746	1,96
20	1,778	1,124	3,729	2,901	2,807	8,189	8,898	5,129	7,046	1,952	1,776	2,06
21	1,825	90	3,043	2,937	4,991	10,016	11,276	5,398	5,974	1,956	289	2,048
22	1,899	1,830	2,763	5,588	4,771	10,825	10,911	5,175	5,075	1,916	2,823	2,004
23	1,159	1,897	2,545	14,245	5,209	11,583	10,207	6,092	4,499	1,201	2,708	1,988
24	116	1,993	2,280	18,698	5,817	11,842	12,315	5,367	3,759	140	2,384	1,238
25	2,048	358	321	15,123	5,908	12,725	11,759	5,097	2,236	1,978	2,033	137
26	2,230	2,145	446	11,927	5,055	16,044	10,211	4,714	2,318	2,312	2,229	1,898
27	2,353	1,622	2,461	10 059	4,712	20,231	12,793	4,774	4,341	2,185	1,340	2,012
28	2,453	1,097	2,216	8,351	8,307	18,353	20,526	4,465	3,491	1,968	120	1,956
29	2,054	4,368	2,138	7,330	....	16,011	18,118	4,267	3,291	1,484	1,320	2,041
30	1,180	3,175	2,053	6,620	....	15,394	13,980	3,953	2,730	1,055	1,396	2,029
31	138	....	2,050	7,421	....	17,953	....	5,385	....	351	1,486	....
1910–11.												
1	1,224	1,452	2,490	560	3,178	3,445	16,615	15,424	3,231	1,414	2,268	2,798
2	136	1,370	2,467	3,460	2,952	3,442	12,196	14,811	2,860	497	2,460	1,798
3	1,848	1,563	1,483	3,210	2,552	3,192	10,369	15,431	1,717	894	2,458	1,361
4	1,795	1,869	110	4,127	1,453	1,982	8,330	13,484	782	117	2,282	1,376
5	1,818	1,515	1,961	4,817	670	658	7,547	10,063	3,312	1,401	1,550	3,200
6	1,810	2,005	1,948	5,819	3,461	3,314	7,673	7,667	3,105	1,891	186	2,328
7	1,831	4,555	1,969	4,356	3,311	2,809	12,968	6,445	2,922	1,456	1,642	2,170
8	1,146	4,144	1,988	3,321	2,967	2,520	17,999	7,238	2,880	925	1,611	2,108
9	163	3,402	1,915	4,831	2,705	2,513	18,741	6,306	2,863	208	1,746	1,289
10	1,848	3,172	1,139	3,829	2,642	2,483	18,171	6,553	1,907	2,627	1,749	115
11	2,068	3,046	87	3,312	1,614	1,531	15,788	6,605	1,593	2,222	1,908	1,876
12	1,218	1,870	1,588	3,107	177	416	14,138	6,220	3,581	1,921	1,156	2,356
13	1,970	442	1,389	3,196	2,447	2,536	13,179	4,965	3,132	1,740	51	2,478
14	1,821	3,042	1,345	2,014	2,233	2,696	13,513	5,247	2,983	1,354	1,285	2,651
15	1,123	2,676	1,355	629	2,237	5,704	15,624	6,507	4,067	931	1,156	2,568
16	111	2,546	1,359	3,625	2,310	12,451	19,189	5,325	4,551	114	1,552	1,449
17	1,710	2,486	797	2,955	2,276	8,511	20,369	4,565	1,763	1,345	1,543	182
18	1,632	2,275	81	2,500	1,402	5,403	16,707	3,702	369	928	1,598	2,595
19	1,630	1,192	1,365	2,437	181	5,041	13,561	3,864	2,519	851	1,138	2,887
20	1,592	173	1,392	2,274	2,437	6,414	12,687	2,367	2,722	964	206	2,618
21	1,651	1,792	1,377	1,558	2,419	4,626	12,610	2,539	2,615	987	1,577	2,330
22	1,003	2,185	1,389	173	2,385	4,858	12,132	4,713	2,510	804	1,729	2,187
23	105	2,195	1,414	1,977	2,342	4,883	11,085	3,323	2,346	98	1,687	1,274
24	1,551	517	948	2,319	2,306	5,023	10,978	3,144	1,622	1,296	1,316	164
25	1,380	2,091	421	2,264	1,539	2,973	9,992	3,036	343	1,441	1,423	1,831
26	1,429	1,427	464	2,283	155	3,058	11,277	3,261	2,437	1,700	976	2,108
27	1,573	183	2,856	2,195	2,606	5,637	12,340	2,160	2,555	1,413	168	2,219
28	1,727	1,982	2,393	1,807	3,622	10,595	13,568	3,110	2,296	1,897	1,538	2,262
29	1,000	2,156	2,446	1,081	....	15,824	14,125	3,259	2,294	1,306	1,719	2,162
30	94	2,266	2,968	3,738	....	17,649	14,262	2,297	1,961	200	1,850	1,421
31	1,560	....	1,949	3,460	....	20,918	....	4,354	....	1,954	1,952	....

rrimack River at Lawrence, Mass., for the years ending
1880–1915—Continued.

n.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
300	2,962	4,511	25,394	9,910	15,218	2,359	2,384	231
715	3,075	3,171	24,821	9,584	14,985	2,622	2,263	509
053	2,251	2,195	24,771	9,032	13,631	2,561	1,452	2,848
706	1,527	4,735	22,306	7,384	12,727	500	196	2,771
508	3,894	3,525	18,986	7,206	11,840	2,268	2,476	2,720
728	3,277	3,345	17,881	8,471	10,236	1,539	2,784	2,619
039	3,028	3,286	20,440	7,886	8,946	384	2,664	1,877
547	2,855	3,447	26,173	9,899	7,367	1,941	2,648	342
946	2,954	2,751	30,720	10,465	6,880	1,738	2,581	2,841
003	2,297	2,118	26,689	11,063	7,744	2,080	1,539	2,904
891	1,003	4,944	21,254	10,683	5,290	2,131	187	2,758
775	3,522	4,428	18,416	9,901	4,936	1,931	2,297	2,143
133	2,962	6,562	16,678	10,269	4,554	1,189	4,160	2,004
152	2,826	10,091	15,709	9,961	4,519	219	4,670	1,318
021	2,716	16,600	16,201	11,331	2,879	1,987	3,580	175
383	2,814	23,200	15,672	10,767	2,641	2,249	3,264	2,351
231	2,216	25,012	17,604	10,878	5,139	2,141	1,891	2,659
920	851	26,067	22,816	14,212	3,853	1,992	345	2,690
373	3,190	25,863	23,500	14,444	3,197	2,131	3,087	2,694
514	3,144	25,262	22,394	12,699	3,625	1,464	2,896	2,978
41	3,231	25,017	20,069	10,909	3,975	213	2,462	1,987
14	2,742	21,445	17,964	11,087	2,556	2,361	2,272	577
39	5,339	18,030	16,689	13,252	796	2,309	2,299	4,006
10	3,848	15,546	18,622	13,215	3,892	2,486	1,474	3,318
85	3,758	12,967	18,508	12,250	3,284	2,713	277	2,971
50	5,964	11,425	14,552	11,143	3,108	2,878	2,857	2,913
50	5,098	10,888	12,877	10,662	2,939	1,753	2,296	3,008
62	4,812	10,650	11,972	9,219	2,386	175	2,187	1,959
76	4,518	13,241	12,994	8,234	1,620	2,227	2,179	285
53	....	23,802	10,940	6,945	201	2,189	2,169	2,422
04	....	26,509	....	11,325	....	2,259	1,282	....
87	5,066	4,557	17,983	9,170	11,599	2,619	1,818	492
40	5,800	6,124	20,694	8,111	10,178	2,589	1,183	2,809
90	7,152	7,074	17,083	6,771	8,278	2,407	160	2,421
77	6,086	6,415	14,120	5,924	7,215	600	1,817	2,195
33	5,726	5,965	12,483	6,846	6,531	526	1,880	2,070
27	5,177	5,662	12,578	5,990	5,965	586	1,854	1,243
70	4,838	4,981	13,075	5,793	4,495	3,112	1,897	171
89	3,149	3,392	11,785	5,501	4,014	2,708	1,962	1,783
74	3,409	2,988	10,486	5,369	5,378	2,501	1,306	1,788
71	5,393	6,200	9,480	3,972	4,153	2,151	198	1,760
45	4,320	6,306	8,947	3,662	3,736	1,909	1,966	1,758
37	3,448	7,167	9,499	5,530	3,605	1,574	1,743	1,790
37	3,513	8,112	12,129	4,205	3,585	247	1,730	1,098
19	3,688	8,085	14,511	3,688	2,270	2,185	1,746	114
74	2,553	12,403	14,723	3,258	1,325	2,319	1,828	1,548
37	1,731	22,790	13,997	4,123	3,898	2,227	1,076	1,482
30	4,871	27,272	13,112	2,657	3,282	2,257	166	1,460
14	3,872	21,775	11,783	3,104	2,766	2,399	1,687	1,412
21	3,517	16,896	10,225	5,006	2,737	1,626	1,678	1,485
19	3,314	14,750	9,141	3,724	2,851	247	1,750	1,046
32	3,192	16,910	9,827	3,742	2,460	2,132	1,826	161
77	1,964	23,190	8,643	3,881	621	1,956	1,816	1,591
51	4,749	27,538	8,114	4,185	4,141	1,864	1,234	1,904
30	7,094	20,547	7,678	4,806	3,063	1,640	303	3,110
53	6,336	16,431	7,790	10,494	2,689	1,699	1,417	4,713
18	5,405	19,380	7,076	12,365	2,624	1,206	1,379	3,495
12	4,647	31,321	7,097	10,877	2,477	99	1,315	2,123
32	5,015	34,757	8,220	9,188	2,036	1,834	1,333	296
10	....	37,040	8,021	9,527	384	1,632	1,452	2,432
6	....	25,651	8,976	14,790	2,598	1,780	859	2,304
7	....	19,650	....	15,106	....	1,828	158	....

Daily discharge, in second-feet, of Merrimack River at Lawrence, Mass., for the years endi Sept. 30, 1880–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	1,939	3,910	5,071	3,974	4,683	3,222	22,560	26,292	5,953	2,878	1,393	4,10
2	2,102	3,516	4,142	3,738	5,863	11,610	24,260	22,902	3,770	3,006	124	3,67
3	2,724	5,332	3,973	2,626	5,189	25,200	31,072	18.683	3.603	3,037	2,214	3,14
4	1,899	4,226	4,125	1,830	6,056	32,600	28,823	17,110	3,596	630	2,264	2,7
5	1,439	3,845	4,490	4,807	7,324	30,750	23,094	16,528	4,087	1,945	2,389	1,8
6	3.986	3,612	3,256	4,084	7,005	28,890	20,545	18,386	4,423	4,017	2,531	1,37
7	3,211	3,634	3,715	3,825	5,609	23,360	17,628	20,322	5,496	3,177	2,360	1,6
8	2,873	2,458	6,435	3,786	5,029	19,397	16,730	19,438	5,771	3,287	1,393	3,2
9	2,333	1,301	7,992	3,821	6,448	16,720	18,783	17,059	5,049	3,172	175	2,8
10	2,625	4,980	8,310	2,614	5,354	15,785	24,844	16,307	4,061	3,154	2,128	2,64
11	2,021	10,092	7,062	1,723	4,751	12,938	24,915	16,487	3,963	1,982	2,127	2,2
12	260	9,799	6,273	4,733	4,622	11,331	21,411	14,787	3,562	2,099	2,100	1,31
13	688	7,054	4,607	3,299	4,207	10,128	20,844	14,504	2,279	4,396	2,184	14
14	3,084	5,808	4,259	3,139	2,932	8,976	19,866	16,131	1,171	3,848	2,140	2,2
15	3,058	4,295	6,059	3,037	2,163	8,637	17,744	16,221	4,595	3,458	1,449	2,2
16	3,183	3,371	5,026	2,793	4,771	8,533	16,686	14,327	3,007	2,701	144	2,2
17	2,933	5,402	4,615	2,207	3,921	8,545	17,308	12,322	2,601	2,420	2,334	2,1
18	2,155	4,377	4,677	541	3,805	8,775	17,322	11,541	2,935	1,572	2,460	2,0
19	371	3,642	4,688	3,410	3,680	9,939	17,635	10,493	3,034	427	2,462	1,2
20	2,995	3,685	2,763	2,825	3,883	9,012	19,289	9,926	2,059	2,706	2,435	1
21	3,731	4,030	2,024	2,918	2,709	7,318	28,823	9,429	603	2,780	2,407	2,0
22	5,228	3,818	5,136	3,142	2,480	7,275	37,144	8,894	3,828	2,724	1,564	2,0
23	6,568	3,695	4,234	3,277	3,298	8,156	29,322	8,053	2,978	2,575	585	1,9
24	5,136	5,341	4,022	2,236	5,147	6,885	21,401	7,338	2,680	2,456	3,269	1,9
25	3,322	4,373	2,435	1,484	3,396	7,093	17,157	8,079	2,737	1,710	2,827	1,9
26	4,333	3,773	6,024	4,562	3,342	7,354	15,161	6,672	2,765	131	2,761	1,1
27	8,190	1,350	3,973	4,311	3,642	10,579	19,768	5,975	1,816	2,322	2,567	1
28	8,083	4,725	3,290	4,810	2,573	18,627	26,938	5,382	435	2,266	2,446	1,6
29	7,599	2,818	5,510	4,877	....	26,545	27,340	5,366	2,938	2,269	1,569	1,6
30	6,402	2,288	4,476	5,188	....	27,742	26,282	3,824	2,951	2,197	402	1,6
31	5,649	....	4,112	5,182	....	24,470	....	4,106	....	2,322	3,134	.....
1914–15.												
1	1,674	143	2,339	1,655	5,069	20,559	4,660	6,784	4,089	2,681	5,333	4,4
2	1,726	1,718	2,317	1,167	4,098	14,444	4,449	11,227	3,299	3,172	6,352	4,2
3	938	1,736	2,488	250	3,648	11,321	3,679	11,020	3,077	4,797	6,025	3,9
4	119	1,768	2,726	1,855	3,291	9,971	4,090	9,462	2,676	10,559	7,765	3,0
5	1,706	1,770	1,887	1,867	3,299	8,539	5,608	8,362	1,799	10,635	15,635	2,5
6	1,694	1,729	710	1,794	2,431	7,427	5,104	7,476	428	9,266	21,786	2,3
7	1,690	1,006	3,656	2,531	1,701	6,967	5,461	6,666	2,302	7,845	18,978	4,4
8	1,706	119	2,919	3,533	5,285	7,918	6,298	5,869	2,411	6,774	15,753	3,8
9	1,736	1,698	2,673	4,226	4,600	6,106	6,843	5,358	2,540	15,303	15,118	2,6
10	980	1,724	2,424	4,300	4,897	6,593	7,736	6,802	2,536	29,926	14,443	2,87
11	113	1,655	2,199	5,178	4,664	6,325	8,790	5,912	2,226	22,714	13,451	1,9
12	69	1,647	1,550	4,211	4,383	6,088	14,045	5,446	1,335	16,713	11,503	8
13	1,660	1,744	458	4,270	3,022	4,685	20,562	5,035	152	12,342	10,060	3,8
14	1,730	1,008	2,638	4,462	2,901	4,548	18,707	4,902	2,238	9,327	8,902	3,2
15	1,719	125	2,980	4,371	5,179	6,321	14,274	3,651	2,389	7,865	8,449	2,8
16	1,682	1,770	2,627	2,823	5,083	5,295	11,538	3,610	2,453	7,114	9,027	2,70
17	1,028	1,796	2,377	1,961	6,750	4,466	9,608	5,418	2,065	5,835	9,209	2,7
18	126	1,885	2,371	5,351	8,218	4,666	8,536	4,352	1,919	5,143	7,929	1,9
19	1,732	2,553	1.451	10,376	8,202	4,761	8,227	3,868	1,221	5,907	6,982	4
20	1,912	2,801	192	13,364	8,090	3,581	8,140	3,745	947	5,218	6,180	2,6
21	1,883	1,924	2,028	13,589	6,080	3,650	7,269	3,617	3,224	4,791	4,595	2,9
22	1,830	696	2,178	10,991	6,030	5,520	6,730	2,693	2,875	4,553	3,819	2,6
23	1,817	3,035	2,195	7,688	7,560	4,794	6,554	1,876	2,740	4,517	5,783	2,81
24	997	2.870	2,119	6,546	7,150	4,617	4,943	4,470	2,829	3,664	9,142	3,77
25	115	2,873	541	7,349	9,100	4,828	4,648	3,365	2,508	3,096	10,347	2,80
26	1,783	947	953	6,287	26,300	5,428	6,260	3,158	1,542	4,603	8,260	1,9
27	1,837	1,611	149	5,649	39,200	5,691	6,643	3,209	408	4,420	7,440	4,2
28	1,720	978	2,069	5,250	27,054	5,313	7,441	3,087	2,570	5,168	5,793	3,12
29	1,692	132	2,031	2,991	....	6,100	6,687	2,007	2,539	6,085	4,592	2,87
30	1,707	2,956	1,967	3,432	....	5,451	6,068	1,587	2,341	6,650	5,286	2,8
31	974	....	2,053	2,813	....	5,059	....	2,174	....	6,200	4,470	.....

NOTE.—The above table shows the actual flow at Lawrence; not corrected for water wasted by the Metropolitan Water and Sewerage Board.

River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915.

eks arranged in order of dryness.]

n second-feet.			Mean discharge in second-feet.			
basins.[c]	Per square mile of net drainage area.[c]	Week ending Sunday.	Measured at Lawrence (total drainage area, 4,663 square miles.[a])	Wasting into Merrimack River from diverted drainage basins.[b]	From net drainage basins.[c]	Per square mile of net drainage area.[c]
		1880–81.				
,172	0.476	Oct. 17	1,583	3	1,580	0.346
,244	.491	24	1,653	3	1,650	.361
287	.501	10	1,782	3	1,779	.390
333	.511	3	1,929	3	1,926	.422
355	.516	Jan. 9	1,942	2	1,940	.425
491	.545	Sept. 4	2,238	2	2,236	.489
492	.546	Jan. 2	2,244	3	2,241	.491
541	.556	July 24	2,255	3	2,252	.493
553	.559	Aug. 21	2,257	2	2,255	.493
581	.565	Oct. 31	2,287	3	2,284	.500
791	.611	Sept. 25	2,306	2	2,304	.504
948	.646	Feb. 6	2,316	2	2,314	.506
948	.646	Aug. 28	2,346	2	2,344	.513
129	.685	Dec. 26	2,430	2	2,428	.532
305	.724	Jan. 16	2,454	0	2,454	.537
506	.768	July 17	2,493	18	2.475	.542
543	.776	Jan. 23	2,531	3	2,528	.553
684	.807	30	2,531	2	2.529	.553
154	.910	Sept. 11	2,578	2	2,576	.564
060	1.108	18	2,657	2	2,655	.581
120	1.121	Dec. 5	2,683	3	2,680	.587
196	1.138	Nov. 28	2,806	3	2,803	.614
223	1.144	Dec. 19	2,810	3	2,807	.615
922	1.297	12	2,839	3	2,836	.621
542	1.432	July 10	3,055	25	3,030	.663
194	1.575	Aug. 14	3,061	3	3,058	.669
238	1.585	Feb. 13	3,117	25	3,092	.677
314	1.799	Nov. 21	3,300	3	3,297	.722
324	1.803	Aug. 7	3,645	3	3,642	.797
350	1.828	June 26	3,744	40	3,704	.811
20	1.997	July 3	4,380	34	4,346	.951
325	2.042	Feb. 27	5,021	137	4,884	1.069
223	2.239	Nov. 14	5,287	3	5,284	1.157
726	2.568	July 31	5,456	3	5,453	1.193
81	2.602	June 12	5,686	265	5,421	1.186
24	3.618	Nov. 7	5,851	3	5,848	1.280
22	3.859	June 19	6,028	175	5,853	1.281
85	3.851	5	6,121	72	6,049	1.324
35	4.059	Feb. 20	8,387	200	8,817	1.791
		Apr. 10	8,925	124	8.801	1.926
		3	9,572	221	9.351	2,046
		May 8	11,618	58	11,560	2.530
		29	11,742	81	11,661	2.552
		Mar. 6	13,065	383	12,682	2.775
		May 15	13,152	45	13,107	2,868
		Mar. 27	15,543	397	15,146	3.314
		Apr. 17	17,964	205	17,759	3.886
		Mar. 20	19,488	447	19,041	4,167
		Apr. 24	20,015	139	19,876	4.349
		May 1	20,726	85	20,641	4.517
		22	22,150	139	22,011	4,817
		Mar. 13	23,091	741	22,350	4.891
		The year....	6,445	80	6,365	1.390

chituate drainage basin, was diverted to Charles River, thus arti-
are mile. Prior to July, 1909, the total drainage area was 4,664

ainage area from which discharge wasted into the Merrimack was
1898, 94 square miles; Mar. 7, 1898, to June 30, 1909, 212 square
uare miles.

e area was 4,567 square miles; Jan. 1, 1881, to Mar. 6, 1898, 4,570
15, 4,452 square miles.

rom diverted drainage area based on data furnished by the Metro-

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1881–82.				
Sept. 3	1,900	2	1,898	0.415
10	1,938	2	1,936	.424
Aug. 27	2,070	2	2,068	.453
20	2,078	2	2,076	.454
6	2,184	2	2,182	.477
Oct. 16	2,207	2	2,205	.483
Aug. 13	2,241	2	2,239	.490
Sept. 17	2,258	2	2,256	.491
July 30	2,272	2	2,270	.497
Oct. 9	2,369	2	2,367	.518
2	2,492	2	2,490	.545
30	2,688	2	2,686	.588
23	2,905	2	2,903	.635
Sept. 24	2,920	2	2,918	.639
July 23	2,932	2	2,930	.641
16	3,412	2	3,410	.746
9	3,989	2	3,987	.872
2	4,025	2	4,023	.880
Dec. 18	4,399	3	4,396	.962
Nov. 6	4,532	2	4,530	.991
Feb. 12	5,114	195	4,919	1.076
Jan. 22	5,420	91	5,329	1.166
Nov. 20	5,507	2	5,505	1.205
Jan. 29	5,515	172	5,343	1.169
Nov. 27	5,547	2	5,545	1.213
Dec. 4	5,639	19	5,610	1.228
11	5,855	3	5,852	1.281
Nov. 13	5,864	2	5,862	1.283
June 18	6,301	29	6,272	1.372
May 7	7,028	42	6,986	1.529
14	7,034	66	6,968	1.525
Feb. 5	7,062	137	6,925	1.515
Dec. 25	7,067	34	7,033	1.539
June 25	7,352	23	7,329	1.604
Jan. 15	7,693	92	7,601	1.663
Apr. 30	7,801	66	7,735	1.693
Jan. 8	8,691	37	8,654	1.894
Apr. 23	10,058	3	10,055	2.200
May 21	10,424	195	10,229	2.238
Mar. 26	10,601	158	10,443	2.285
Apr. 16	10,696	37	10,659	2.332
2	12,336	108	12,228	2.676
Feb. 19	12,533	361	12,172	2.664
Apr. 9	12,665	55	12,610	2.759
Feb. 26	12,926	290	12,636	2.765
June 11	13,400	69	13,331	2.917
Mar. 19	13,722	251	13,471	2.948
May 28	14,358	205	14,153	3.097
June 4	17,175	123	17,032	3.731
Mar. 5	19,056	605	18,451	4.037
Jan. 1	19,093	106	18,987	4.155
Mar. 12	22,297	425	21,872	4.786
The year	7,262	78	7,184	1.572

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1882–83.				
Sept. 30	1,110	2	1,108	0.24
16	1,180	2	1,178	.25
23	1,221	2	1,219	.26
9	1,512	2	1,510	.33
2	1,613	2	1,611	.35
Aug. 26	1,637	2	1,635	.35
19	1,737	2	1,735	.38
Jan. 21	1,827	2	1,825	.39
14	1,885	2	1,883	.41
Dec. 3	1,894	2	1,892	.41
Jan. 7	2,095	2	2,093	.45
28	2,119	2	2,117	.46
Dec. 24	2,148	2	2,146	.47
31	2,171	2	2,169	.47
10	2,177	2	2,175	.47
Feb. 4	2,178	2	2,176	.47
Aug. 12	2,189	2	2,187	.47
Dec. 17	2,281	2	2,279	.49
Feb. 11	2,294	2	2,292	.50
Nov. 12	2,317	2	2,315	.50
Aug. 5	2,392	2	2,390	.52
Nov. 19	2,404	2	2,402	.52
26	2,416	2	2,414	.52
Feb. 18	2,460	40	2,420	.53
July 29	2,483	2	2,481	.54
Oct. 15	2,583	2	2,581	.56
Nov. 5	2,628	2	2,626	.57
July 15	2,856	2	2,854	.62
8	2,934	2	2,932	.64
Mar. 18	2,967	165	2,802	.61
Oct. 8	2,989	2	2,987	.65
29	3,040	2	3,038	.66
Mar. 11	3,353	78	3,275	.71
July 1	3,483	3	3,480	.76
Oct. 22	3,705	2	3,703	.81
Mar. 4	3,797	137	3,660	.80
Feb. 25	4,124	87	4,037	.88
Mar. 25	4,275	243	4,032	.88
July 22	4,459	3	4,456	.97
June 10	4,649	20	4,629	1.01
17	4,876	11	4,865	1.06
24	6,367	3	6,364	1.39
Apr. 1	6,383	134	6,249	1.36
May 20	6,609	7	6,602	1.44
June 3	7,039	67	6,972	1.52
May 6	7,767	12	7,755	1.69
Apr. 8	8,351	41	8,310	1.81
Oct. 1	8,660	2	8,658	1.89
May 13	9,361	3	9,358	2.04
27	10,793	230	10,563	2.31
Apr. 29	12,075	68	12,007	2.62
15	20,566	118	20,448	4.47
22	23,469	101	23,368	5.11
The year	4,413	31	4,382	.95

ck River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

ge in second-feet.		Week ending Sunday.	Mean discharge in second-feet.			
From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles.	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
		1884–85.				
1,681	0.368	Oct. 26	1,682	2	1,680	0.368
1,756	.384	19	1,748	2	1,746	.382
1,781	.390	12	1,839	2	1,837	.402
1,795	.393	Aug. 2	1,867	2	1,865	.408
1,805	.395	Nov. 23	1,874	2	1,872	.410
1,807	.395	Oct. 5	1,886	2	1,884	.412
1,808	.396	Nov. 2	1,932	2	1,930	.422
1,906	.417	16	2,063	2	2,061	.451
2,089	.457	Sept. 27	2,086	2	2,084	.456
2,087	.457	July 26	2,121	3	2,118	.463
2,117	.463	June 28	2,138	3	2,135	.467
2,158	.472	Nov. 9	2,266	12	2,254	.493
2,160	.473	Mar. 29	2,344	130	2,214	.484
2,179	.477	June 21	2,653	3	2,650	.580
2,200	.481	Sept. 20	2,718	2	2,716	.594
2,203	.482	July 19	2,724	2	2,722	.596
2,278	.498	Dec. 7	2,738	2	2,736	.599
2,316	.507	Mar. 22	3,367	125	3,242	.709
2,327	.509	Feb. 8	3,441	35	3,406	.745
2,318	.507	July 5	3,453	3	3,450	.755
2,366	.518	Sept. 6	3,481	2	3,479	.761
2,529	.553	13	3,554	2	3,552	.777
2,548	.558	Mar. 1	3,671	104	3,567	.781
2,566	.561	Nov. 30	3,756	2	3,754	.821
2,924	.640	Aug. 30	3,786	2	3,784	.828
3,300	.722	Jan. 25	3,801	90	3,711	.812
3,693	.808	July 12	3,804	5	3,799	.831
3,783	.828	Dec. 21	3,856	9	3,847	.842
3,968	.868	Mar. 15	4,011	137	3,874	.848
4,044	.885	Aug. 23	4,463	2	4,461	.976
4,318	.945	Mar. 8	4,496	273	4,223	.924
4,297	.940	May 31	4,730	74	4,656	1.019
4,908	1.074	Feb. 22	4,927	191	4,736	1.036
5,371	1.175	Jan. 11	5,339	130	5,209	1.140
5,717	1.251	Feb. 1	5,409	48	5,361	1.173
5,844	1.279	Dec. 14	5,429	6	5,423	1.187
6,721	1.470	Feb. 15	5,644	246	5,398	1.181
7,650	1.678	Jan. 4	5,881	130	5,751	1.258
8,630	1.888	18	6,101	188	5,913	1.294
9,885	2.163	June 7	6,160	75	6,085	1.332
10,587	2.317	14	6,163	57	6,106	1.336
10,632	2.326	Dec. 28	6,319	143	6,176	1.351
10,844	2.373	May 24	6,823	156	6,667	1.459
11,759	2.573	Aug. 9	7,063	2	7,061	1.545
11,431	2.501	16	7,873	2	7,871	1.722
15,094	3.303	May 17	8,574	151	8,423	1.843
15,915	3.482	10	10,393	160	10,233	2.239
22,563	4.937	Apr. 5	10,510	351	10,159	2.223
25,061	5.484	19	16,333	138	16,195	3.544
26,607	5.822	May 3	17,510	233	17,277	3.781
32,747	7.166	Apr. 26	20,971	59	20,912	4.576
33,457	7.321	12	21,600	246	21,354	4.673
6,972	1.526	The year	5,373	72	5,301	1.160

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 3
1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.				Week ending Sunday.	Mean discharge in second-fe			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1885–86.					1886–87.				
Sept. 19	1,788	2	1,786	0.391	Oct. 24	1,786	2	1,784	0.3
12	1,837	2	1,835	.402	17	1,936	2	1,934	.4
5	1,879	2	1,877	.411	10	2,156	2	2,154	.4
Aug. 29	1,909	2	1,907	.417	31	2,242	2	2,240	.4
July 12	1,919	2	1,917	.419	3	2,916	2	2,914	.6
Aug. 15	1,970	2	1,968	.431	Sept. 25	3,178	2	3,176	.6
8	2,068	2	2,066	.452	July 24	3,499	2	3,497	.7
Sept. 26	2,090	2	2,088	.457	June 19	3,665	8	3,657	.8
July 18	2,137	2	2,135	.467	July 17	4,003	2	4,001	.8
Aug. 1	2,167	2	2,165	.474	10	4,006	2	4,004	.8
22	2,170	2	2,168	.474	Jan. 23	4,306	112	4,194	.9
Oct. 4	2,221	2	2,219	.486	Sept. 18	4,314	2	4,312	.9
July 4	2,630	2	2,628	.575	Jan. 16	4,333	85	4,248	.9
25	2,666	2	2,664	.583	Dec. 19	4,701	3	4,698	1.0
Oct. 11	2,721	2	2,719	.595	Sept. 11	4,804	2	4,802	1.0
18	2,792	2	2,790	.611	Nov. 7	4,919	2	4,917	1.0
June 27	2,830	2	2,828	.619	Dec. 12	4,920	3	4,917	1.0
13	2,997	2	2,995	.655	Nov. 14	5,032	2	5,030	1.1
20	3,667	2	3,665	.802	Aug. 14	5,240	50	5,190	1.1
6	3,911	18	3,893	.852	Jan. 9	5,520	93	5,427	1.1
Nov. 1	4,485	2	4,483	.981	Dec. 26	5,677	82	5,595	1.2
Dec. 6	4,756	103	4,653	1.018	Mar. 13	6,115	318	5,797	1.2
Oct. 25	4,891	2	4,889	1.070	Dec. 5	6,544	6	6,538	1.4
May 30	5,023	25	4,998	1.094	Aug. 21	6,730	35	6,695	1.4
Nov. 29	5,457	204	5,253	1.149	7	6,939	66	6,873	1.5
22	6,136	52	6,084	1.331	Mar. 6	7,196	172	7,024	1.5
Dec. 27	6,283	174	6,109	1.337	May 29	7,269	5	7,264	1.5
May 9	6,427	69	6,358	1.391	Sept. 4	7,366	2	7,364	1.6
Dec. 13	7,209	101	7,108	1.555	July 3	7,560	2	7,558	1.6
May 23	7,316	78	7,238	1.584	May 22	7,645	43	7,602	1.6
Jan. 31	7,590	151	7,439	1.628	Mar. 20	7,724	336	7,388	1.6
3	7,996	127	7,869	1.722	June 12	7,926	35	7,891	1.7
Feb. 7	8,227	149	8,078	1.768	Jan. 2	8,231	137	8,094	1.7
Mar. 14	8,266	150	8,116	1.776	Nov. 21	8,711	2	8,709	1.9
21	8,300	223	8,077	1.767	28	9,467	2	9,465	2.0
May 16	8,437	101	8,336	1.824	June 26	9,599	5	9,594	2.0
Jan. 24	9,161	88	9,073	1.985	Feb. 20	10,207	293	9,914	2.1
May 2	9.790	61	9,729	2.129	Mar. 27	10,694	397	10,297	2.2
Nov. 8	10,193	16	10,177	2.227	Feb. 27	10,761	428	10,333	2.2
Dec. 20	10,437	237	10,200	2.232	Apr. 3	11,306	462	10,844	2.3
Mar. 28	11,469	330	11,139	2.437	Feb. 13	11,404	186	11,218	2.4
Feb. 14	13,353	772	12,581	2.753	June 5	11,857	76	11,781	2.5
Jan. 17	14,754	70	14,684	3.213	Apr. 10	14,049	365	13,684	2.9
Nov. 15	15,926	138	15,788	3.455	Jan. 30	14,051	896	13,155	2.8
Feb. 28	16,099	385	15,714	3.439	May 15	14,457	102	14,355	3.1
Mar. 7	18,289	167	18,122	3.965	Aug. 28	15,160	13	15,147	3.3
Apr. 25	20,767	116	20,651	4.519	July 31	16,171	31	16,140	3.5
Jan. 10	22,010	209	21,801	4.770	Apr. 24	21,443	240	21,203	4.6
Apr. 18	23,290	195	23,095	5.054	May 8	23,350	220	23,130	5.0
11	26,229	464	25,765	5.638	Feb. 6	23,910	411	23,499	5.1
4	26,767	303	26,464	5.791	May 1	28,229	383	27,846	6.0
Feb. 21	34,286	1,066	33,280	7.282	Apr. 17	31,879	281	31,598	6.9
The year	8,423	122	8,301	1.816	The year	8,813	123	8,690	1.9

River at Lawrence, Mass., for the years ending Sept. 30, 1880-1915—Continued.

in second-feet.		Week ending Sunday.	Mean discharge in second-feet.			
From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles.	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
		1888-89.				
2,182	0.477	Sept. 8	2,210	16	2,194	0.480
2,249	.492	15	2,373	47	2,326	.509
2,295	.502	1	2,527	65	2,462	.539
2,376	.520	July 14	2,741	9	2,732	.598
2,390	.523	21	2,853	26	2,827	.619
2,405	.526	June 30	3,070	8	3,062	.670
2,429	.532	July 7	3,106	12	3,094	.677
,521	.552	Aug. 25	3,557	-161	3,396	.743
,617	.573	June 23	4,133	17	4,116	.901
,778	.608	Mar. 3	4,410	66	4,344	.951
,789	.610	Sept. 29	4,437	91	4,346	.951
,802	.613	Aug. 18	4,493	316	4,177	.914
,937	.643	May 19	4,506	2	4,504	.986
,973	.651	Sept. 22	5,181	145	5,036	1.102
,051	.668	July 28	5,324	39	5,285	1.156
,152	.690	June 2	5,344	117	5,227	1.143
,249	.711	Feb. 17	5,860	79	5,781	1.265
,489	.763	May 12	5,934	16	5,918	1.295
281	.718	Feb. 24	6,517	176	6,341	1.388
624	.793	Aug. 11	6,667	198	6,469	1.416
706	.811	Feb. 10	6,781	128	6,653	1.456
822	.836	June 16	6,990	24	6,966	1.524
861	.851	May 26	7,631	90	7,541	1.650
971	.869	June 9	7,686	213	7,473	1.635
502	.985	Aug. 4	7,823	262	7,561	1.654
660	1.020	Feb. 3	8,199	224	7,975	1.745
708	1.030	Dec. 16	8,634	245	8,389	1.836
885	1.069	Jan. 27	9,696	259	9,437	2.065
012	1.097	Apr. 28	10,040	125	9,915	2.170
242	1.147	Nov. 11	10,213	200	10,013	2.191
618	1.229	Apr. 21	10,354	95	10,259	2.245
607	1.227	Mar. 17	10,634	118	10,516	2.301
682	1.243	Jan. 6	10,649	230	10,419	2.280
074	1.329	Apr. 7	11,027	200	10,827	2.369
163	1.349	Oct. 7	11,131	230	10,901	2.385
004	1.533	21	11,216	177	11,039	2.416
444	2.067	Mar. 31	11,253	87	11,166	2.443
520	2.083	24	11,343	121	11,222	2.456
396	2.056	Apr. 14	11,369	105	11,264	2.465
395	2.493	Oct. 28	11,594	218	11,376	2.489
227	2.675	Nov. 25	12,000	209	11,791	2.580
593	2.756	May 5	12,099	113	11,986	2.623
589	3.214	Nov. 4	12,663	193	12,470	2.729
072	3.298	Dec. 9	13,050	263	12,787	2.798
874	3.474	Jan. 20	13,594	299	13,295	2.909
901	4.792	Dec. 30	13,991	322	13,669	2.991
597	4.726	Mar. 10	13,996	245	13,751	3.009
881	4.897	Oct. 14	14,311	291	14,020	3.068
948	5.043	Nov. 18	15,239	297	14,942	3.270
714	5.408	Jan. 13	17,431	546	16,885	3.695
256	5.526	Dec. 2	20,684	736	19,948	4.365
744	6.071	23	22,151	689	21,462	4.696
72	6.471					
48	1.827	The year	8,860	176	8,684	1.900

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept.
1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1889–90.				
Aug. 17	1,761	2	1,759	0.385
11	2,216	2	2,214	.484
24	2,243	2	2,241	.490
July 20	2,346	2	2,344	.513
27	2,736	2	2,734	.598
13	3,236	2	3,234	.708
Oct. 27	3,524	120	3,404	.745
July 6	3,596	4	3,592	.786
Aug. 3	3,690	2	3,688	.807
June 29	4,259	11	4,248	.930
Oct. 6	4,740	72	4,668	1.021
Feb. 2	4,761	107	4,654	1.018
Sept. 14	5,056	17	5,039	1.103
Oct. 20	5,526	192	5,334	1.167
Nov. 17	5,694	92	5,602	1.226
Sept. 7	6,006	2	6,004	1.314
Feb. 23	6,161	108	6,053	1.325
9	6,224	152	6,072	1.329
Nov. 3	6,401	128	6,273	1.373
Jan. 26	6,549	110	6,439	1.409
19	6,723	171	6,552	1.434
Sept. 28	7,179	6	7,173	1.570
June 22	7,284	36	7,248	1.586
Jan. 12	7,463	124	7,339	1.606
Aug. 31	7,751	2	7,749	1.696
Oct. 13	8,313	142	8,171	1.788
Nov. 24	8,396	175	8,221	1.799
Feb. 16	8,781	160	8,621	1.886
Jan. 5	9,178	146	9,032	1.976
June 15	9,463	36	9,427	2.063
Nov. 10	9,966	81	9,885	2.163
June 8	10,334	67	10,267	2.247
Dec. 7	10,483	294	10,189	2.230
Mar. 9	11,830	339	11,491	2.514
May 25	12,183	90	12,093	2.646
Dec. 29	12,387	242	12,145	2.658
May 4	12,454	124	12,330	2.698
Apr. 27	12,851	107	12,744	2.789
Dec. 22	13,023	272	12,751	2.790
Mar. 16	13,473	481	12,992	2.843
May 18	14,040	147	13,893	3.040
June 1	14,327	126	14,201	3.107
Mar. 2	14,536	253	14,283	3.125
Dec. 1	14,694	463	14,231	3.114
Mar. 23	15,130	506	14,624	3.200
Apr. 6	15,826	336	15,490	3.389
Sept. 21	16,027	56	15,971	3.495
Dec. 15	16,660	289	16,371	3.582
May 11	17,730	195	17,535	3.837
Apr. 20	19,767	153	19,614	4.292
Mar. 30	20,770	608	20,162	4.412
Apr. 13	22,021	292	21,729	4.755
The year	9,380	147	9,233	2.020

Week ending Sunday.	Mean discharge in second-f			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net
1890–91.				
Aug. 16	1,976	2	1,974	0.
Sept. 27	2,116	2	2,114	
Aug. 23	2,123	2	2,121	
Sept. 20	2,316	2	2,314	
Aug. 9	2,336	2	2,334	
July 19	2,517	2	2,515	
Aug. 2	2,631	2	2,629	
Sept. 13	2,923	2	2,921	
July 5	3,001	7	2,994	
26	3,026	2	3,024	
Aug. 30	3,240	2	3,238	
July 12	3,289	2	3,287	
Sept. 6	3,321	2	3,319	
June 21	3,367	5	3,362	
14	4,033	9	4,024	
Dec. 7	4,856	52	4,804	1.
June 28	4,930	32	4,898	1.
Dec. 14	5,047	30	5,017	1.
May 31	5,074	8	5,066	1.
Oct. 5	5,106	26	5,080	1.
June 7	5,979	20	5,959	1.
Dec. 21	6,169	198	5,971	1.
Nov. 30	6,373	54	6,319	1.
Oct. 12	6,567	68	6,499	1.
Jan. 11	6,783	109	6,674	1.
May 17	6,964	7	6,957	1.
Nov. 16	7,250	92	7,158	1.
May 24	7,820	41	7,779	1.
Dec. 28	7,894	106	7,788	1.
May 10	8,473	58	8,415	1.
Jan. 4	9,326	107	9,219	2.
Oct. 19	9,520	127	9,393	2.
Nov. 9	9,551	126	9,425	2.
Feb. 15	10,040	330	9,710	2.
Nov. 23	10,817	124	10,693	2.
May 3	11,254	78	11,176	2.
Feb. 22	12,424	519	11,905	2.
8	13,163	450	12,713	2.
Jan. 18	14,094	521	13,573	2.
Nov. 2	15,037	297	14,740	3.
Mar. 8	15,406	509	14,897	3.
Jan. 25	16,569	705	15,864	3.
Apr. 12	18,126	382	17,744	3.
Feb. 1	18,976	387	18,589	4.
Mar. 1	20,341	560	19,781	4.
22	21,260	453	20,807	4.
Apr. 26	22,239	137	22,102	4.
5	23,271	461	22,810	4.
Oct. 26	23,979	462	23,517	5.
Mar. 15	23,993	893	23,100	5.
Apr. 19	28,729	290	28,439	6.
Mar. 29	33,057	538	32,519	7.
The year	9,975	181	9,794	2.

River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

in second-feet.		Week ending Sunday.	Mean discharge in second-feet.			
From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
		1892–93.				
1,918	0.420	Oct. 23	1,964	2	1,962	0.429
1,928	.422	Aug. 20	2,029	2	2,027	.444
1,995	.437	6	2,043	2	2,041	.447
2,003	.438	Oct. 16	2,166	2	2,164	.474
2,120	.464	Aug. 13	2,174	2	2,172	.475
2,134	.467	Jan. 29	2,179	2	2,177	.476
2,247	.492	Oct. 30	2,201	2	2,199	.481
2,337	.511	July 30	2,243	2	2,241	.490
2,388	.523	Feb. 5	2,257	2	2,255	.493
2,439	.534	Oct. 9	2,278	2	2,276	.498
2,491	.545	July 23	2,286	2	2,284	.500
2,589	.567	16	2,425	2	2,423	.530
2,848	.623	Sept. 17	2,430	2	2,428	.531
,016	.660	Jan. 22	2,439	2	2,437	.533
,147	.689	July 9	2,529	2	2,527	.553
,279	.718	Sept. 10	2,659	2	2,657	.581
,390	.742	Nov. 6	2,720	2	2,718	.595
,350	.733	Oct. 2	2,736	2	2,734	.598
,554	.778	Sept. 24	2,807	2	2,805	.614
,584	.784	Jan. 15	2,828	2	2,826	.618
,619	.792	Aug. 27	3,065	2	3,063	.670
,651	.799	Jan. 1	3,447	2	3,445	.754
,761	.823	Dec. 25	3,621	2	3,619	.792
,977	.870	July 2	3,736	2	3,734	.817
,104	.898	June 25	3,818	2	3,816	.835
,570	1.000	Mar. 5	3,912	35	3,877	.848
,968	1.087	June 18	3,930	2	3,928	.860
,942	1.081	Dec. 18	4,058	5	4,053	.887
,007	1.096	4	4,166	4	4,162	.911
,198	1.137	11	4,227	5	4,222	.924
,161	1.129	Mar. 12	4,339	239	4,100	.897
,497	1.203	Nov. 13	4,426	2	4,424	.968
,671	1.241	Sept. 3	4,513	2	4,511	.987
,406	1.402	Feb. 26	4,552	23	4,529	.991
,278	1.374	June 11	4,587	3	4,584	1.003
,608	1.446	Jan. 8	4,711	4	4,707	1.030
,541	1.431	Feb. 12	4,945	71	4,874	1.067
,700	1.466	June 4	6,839	32	6,807	1.489
,878	1.505	Nov. 27	7,744	12	7,732	1.692
,376	1.614	Feb. 19	7,775	120	7,655	1.675
,613	1.885	Nov. 20	11,391	2	11,389	2.492
,716	1.907	Mar. 26	11,415	244	11,171	2.444
955	1.960	May 28	12,410	116	12,294	2.690
848	1.936	Apr. 2	13,340	271	13,069	2.860
157	2.004	30	14,267	163	14,104	3.086
166	2.006	9	14,711	218	14,493	3.171
383	2.053	23	15,850	250	15,600	3.414
866	2.159	16	18,487	217	18,270	3.998
281	2.250	Mar. 19	19,119	604	18,515	4.051
571	2.313	May 14	20,357	276	20,081	4.394
249	3.118	21	23,167	366	22,801	4.989
388	4.242	7	27,050	542	26,508	5.800
516	1.207	The year	6,565	75	6,490	1.420

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept.
1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1893–94.				
Sept. 9	1,235	2	1,233	0.270
2	1,526	2	1,524	.333
Aug. 26	1,558	2	1,556	.340
19	1,702	2	1,700	.372
12	1,806	2	1,804	.395
Sept. 16	1,828	2	1,826	.400
Aug. 5	1,889	2	1,887	.413
Oct. 8	2,023	2	2,021	.442
15	2,033	2	2,031	.444
July 29	2,088	2	2,086	.456
22	2,101	2	2,099	.459
Feb. 11	2,194	2	2,192	.480
Sept. 30	2,225	2	2,223	.486
Oct. 1	2,252	2	2,250	.492
Sept. 23	2,334	2	2,332	.510
July 15	2,370	2	2,368	.518
8	2,469	2	2,467	.540
Jan. 28	2,537	2	2,535	.555
Nov. 19	2,739	2	2,737	.599
Jan. 21	2,881	2	2,879	.630
Feb. 4	2,917	2	2,915	.638
July 1	3,060	2	3,058	.669
Nov. 26	3,149	2	3,147	.689
Jan. 7	3,156	2	3,154	.690
Oct. 22	3,192	2	3,190	.698
Jan. 14	3,221	2	3,219	.704
June 24	3,309	2	3,307	.724
Nov. 12	3,319	2	3,317	.726
May 20	3,452	2	3,450	.755
Feb. 18	3,564	2	3,562	.779
June 17	3,939	4	3,935	.861
Dec. 3	4,460	2	4,458	.976
10	4,668	2	4,666	1.021
17	4,740	2	4,738	1.037
24	5,206	2	5,204	1.139
Oct. 29	5,772	2	5,770	1.263
Nov. 5	5,993	2	5,991	1.311
Mar. 4	6,004	82	5,922	1.296
May 13	6,314	2	6,312	1.381
Dec. 31	6,571	2	6,569	1.437
Feb. 25	6,726	16	6,710	1.468
May 27	7,323	13	7,310	1.600
6	8,307	35	8,272	1.810
Apr. 8	8,659	10	8,649	1.893
15	9,381	186	9,195	2.012
June 10	10,421	19	10,402	2.276
Apr. 1	10,824	28	10,796	2.362
22	11,261	176	11,085	2.426
June 3	12,526	83	12,443	2.723
Mar. 25	15,589	51	15,538	3.400
Apr. 29	15,689	94	15,595	3.412
Mar. 18	17,460	98	17,362	3.799
11	18,070	372	17,698	3.873
The year	5,284	25	5,259	1.151

Week ending Sunday.	Mean discharge in second-f			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net
1894–95.				
Sept. 29	1,544	2	1,542	0
22	1,731	2	1,729	
8	1,791	2	1,789	.
15	1,816	2	1,814	.
Oct. 7	1,847	2	1,845	.
Sept. 1	1,907	2	1,905	.
Aug. 18	2,079	2	2,077	.
July 28	2,101	2	2,099	.
Oct. 28	2,129	2	2,127	.
14	2,151	2	2,149	.
Aug. 11	2,194	2	2,192	.
Feb 17	2,235	2	2,233	.
Mar. 3	2,276	2	2,274	.
Jan. 6	2,283	2	2,281	.
Feb. 24	2,283	2	2,281	.
Aug. 4	2,301	2	2,299	.
June 23	2,314	2	2,312	.
Aug. 25	2,340	2	2,338	.
Feb. 10	2,397	2	2,395	.
Jan. 13	2,487	7	2,480	.
Dec. 9	2,506	2	2,504	.
July 21	2,510	2	2,508	.
Dec. 30	2,595	4	2,591	.
Nov. 4	2,682	2	2,680	.
Oct. 21	2,693	2	2,691	.
Dec. 2	2,748	20	2,728	.
June 30	2,792	2	2,790	.
Feb. 3	2,812	19	2,793	.
July 7	2,843	2	2,841	.
14	2,846	2	2,844	.
June 16	2,916	2	2,914	.
Jan. 27	3,047	44	3,003	.
Mar. 10	3,285	2	3,283	.
Nov. 18	3,304	37	3,267	.
Dec. 16	3,390	3	3,387	.
Nov. 25	3,475	19	3,456	.
Jan. 20	3,523	53	3,470	.
June 9	3,830	4	3,826	.
Dec. 23	4,003	32	3,971	.
May 26	4,032	4	4,028	.
Nov. 11	4,632	23	4,609	1.
June 2	4,885	3	4,882	1.
May 19	6,187	2	6,185	1.
Mar. 17	6,451	241	6,210	1.
24	6,576	103	6,473	1,
May 12	7,272	19	7,253	1.
Apr. 7	7,387	112	7,275	1.
Mar. 31	8,811	127	8,684	1.
May 5	9,360	79	9,281	2.
Apr. 28	14,130	129	14,001	3.
14	23,043	301	22,742	4.
21	37,502	445	37,057	8.
The year	4,621	36	4,585	1.

River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

in second-feet.		Week ending Sunday.	Mean discharge in second-feet.			
From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
		1896–97.				
,799	0.394	Sept. 19	2,519	4	2,515	0.550
,803	.395	26	2,573	5	2,568	.562
,843	.403	Jan. 31	2,716	2	2,714	.594
,912	.418	Sept. 12	2,731	2	2,729	.597
,919	.420	Feb. 7	2,749	2	2,747	.601
,912	.418	Jan. 3	2,756	2	2,754	.603
,000	.438	Oct. 4	2,795	2	2,793	.611
,105	.461	Dec. 27	3,005	2	3,003	.657
,132	.467	Jan. 24	3,005	2	3,003	.657
,168	.474	17	3,217	2	3,215	.704
,234	.489	Oct. 11	3,303	2	3,301	.722
,239	.490	Sept. 5	3,388	3	3,385	.741
,474	.541	Feb. 28	3,934	2	3,932	.860
,100	.678	Aug. 22	4,070	7	4,063	.889
,134	.686	Dec. 20	4,111	5	4,106	.898
,381	.740	Feb. 21	4,332	2	4,330	.947
,442	.753	Aug. 29	4,501	5	4,496	.984
,566	.780	July 11	4,594	7	4,587	1.004
,579	.783	Aug. 15	4,621	23	4,598	1.006
,879	.849	Nov. 22	4,708	14	4,694	1.027
,919	.858	Jan. 10	5,168	9	5,159	1.129
,105	.898	Mar. 7	5,282	4	5,278	1.155
,136	.905	Nov. 29	5,379	18	5,361	1.173
,226	.925	1	5,791	2	5,789	1.267
,249	.930	Dec. 6	5,877	11	5,866	1.284
,426	.968	13	5,882	17	5,865	1.283
,171	1.132	July 4	5,977	19	5,958	1.304
,383	1.178	Oct. 18	6,080	2	6,078	1.330
917	1.295	Aug. 8	6,760	54	6,706	1.467
004	1.314	Oct. 25	7,036	2	7,034	1.539
335	1.386	Feb. 14	7,267	2	7,265	1.590
907	1.511	Nov. 15	7,855	29	7,826	1.712
578	1.439	May 30	8,128	4	8,124	1.778
295	1.596	June 27	8,346	15	8,331	1.823
967	1.743	Nov. 8	8,628	14	8,614	1.885
281	1.812	June 6	8,782	28	8,754	1.916
590	1.880	May 23	9,060	5	9,055	1.981
191	2.230	Mar. 21	9,635	47	9,588	2.098
058	2.420	July 25	10,261	9	10,252	2.243
445	2.504	Aug. 1	10,395	45	10,350	2.265
199	2.669	May 9	10,701	29	10,672	2.335
089	2.864	Mar. 14	11,206	38	11,168	2.444
269	2.904	May 16	12,684	52	12,632	2.764
315	2.914	2	13,046	8	13,038	2.853
569	2.969	Apr. 4	13,735	74	13,661	2.989
598	2.975	June 20	15,280	47	15,233	3.333
188	3.105	Mar. 28	15,545	236	15,309	3.350
910	3.919	Apr. 25	15,724	17	15,707	3.437
034	4.165	18	19,577	120	19,457	4.258
778	4.547	July 18	20,371	4	20,367	4.457
405	5.559	June 13	20,975	145	20,830	4.558
703	8.469	Apr. 11	21,402	128	21,274	4.655
651	1.674	The year	7,836	26	7,810	1.709

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept.
1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1897–98.				
Oct. 31	2,086	2	2,084	0.456
10	2,241	2	2,239	.490
Sept. 25	2,269	19	2,250	.505
Oct. 24	2,301	4	2,297	.503
Sept. 18	2,346	40	2,306	.518
Oct. 17	2,438	4	2,434	.533
July 17	2,494	66	2,428	.545
Oct. 3	2,516	5	2,511	.549
July 31	2,536	68	2,468	.554
Aug. 7	2,584	111	2,473	.555
July 24	2,689	56	2,633	.591
10	2,732	39	2,693	.605
Sept. 11	2,842	129	2,713	.609
Aug. 14	3,422	370	3,052	.686
Sept. 4	3,442	218	3,224	.724
Aug. 21	3,867	549	3,318	.745
July 3	4,049	92	3,957	.889
Nov. 28	5,113	2	5,111	1.118
Aug. 28	5,129	409	4,720	1.060
Nov. 7	5,145	6	5,139	1.125
Dec. 5	5,321	3	5,318	1.164
Feb. 6	5,482	208	5,274	1.154
Jan. 2	5,663	3	5,660	1.239
Nov. 14	5,902	10	5,892	1.289
Jan. 9	6,043	2	6,041	1.322
June 19	6,224	107	6,117	1.374
Feb. 13	6,403	118	6,285	1.375
Nov. 21	6,434	7	6,427	1.406
June 26	6,439	167	6,272	1.409
12	6,507	159	6,348	1.426
Dec. 12	6,632	5	6,627	1.450
Jan. 16	6,849	2	6,847	1.498
23	8,011	27	7,984	1.747
May 22	8,837	181	8,656	1.944
Feb. 20	8,860	178	8,682	1.900
Mar. 6	9,076	549	8,527	1.866
Jan. 30	9,450	57	9,393	2.055
June 5	9,459	289	9,170	2.060
Feb. 27	9,877	690	9,187	2.010
May 15	10,094	187	9,907	2.225
Dec. 26	10,445	46	10,399	2.275
May 29	10,898	375	10,523	2.364
Apr. 10	11,187	257	10,930	2.455
Mar. 13	11,319	782	10,537	2.367
Apr. 17	11,923	370	11,553	2.595
May 8	12,895	435	12,460	2.799
Apr. 24	14,199	479	13,720	3.082
3	18,055	242	17,813	4.001
Dec. 19	21,554	112	21,442	4.692
May 1	22,793	870	21,923	4.924
Mar. 27	23,529	403	23,126	5.195
20	29,457	957	28,500	6.402
The year	7,847	201	7,646	1.695

Week ending Sunday.	Mean discharge in second-fe			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net
1898–99.				
Sept. 24	1,757	7	1,750	0.
Aug. 27	1,793	8	1,785	.
Sept. 3	1,848	6	1,842	.
17	1,885	6	1,879	.
Aug. 20	2,127	7	2,120	.
July 9	2,233	9	2,224	.
Aug. 13	2,245	7	2,238	.
Sept. 10	2,251	6	2,245	.
July 23	2,362	6	2,356	.
Aug. 6	2,388	7	2,381	.
July 2	2,438	10	2,428	.
16	2,741	10	2,731	.
June 25	2,765	8	2,757	.
July 30	2,768	7	2,761	.
June 18	2,818	11	2,807	.
11	3,078	11	3,067	.
Feb. 19	3,933	242	3,691	.
June 4	3,945	31	3,914	.
Oct. 2	4,043	47	3,996	.
Feb. 12	4,145	177	3,968	.
Oct. 9	4,397	122	4,275	.
16	4,557	269	4,288	.
Feb. 5	4,915	248	4,667	1.
May 28	5,093	70	5,023	1.
21	6,072	27	6,045	1.
Feb. 26	6,346	407	5,939	1.
Oct. 23	6,437	443	5,994	1.
Dec. 18	6,760	241	6,519	1.
Mar. 5	7,143	567	6,576	1.
Nov. 6	7,209	341	6,868	1.
Jan. 29	7,241	459	6,782	1.
1	7,271	243	7,028	1.
15	7,324	398	6,926	1.
Dec. 25	7,374	285	7,089	1.
4	8,407	603	7,804	1.
Jan. 8	8,533	667	7,866	1.
Nov. 13	8,847	578	8,269	1.
Jan. 22	9,128	496	8,632	1.
May 14	9,170	112	9,058	2.
Nov. 20	10,890	673	10,217	2.
Oct. 30	11,067	523	10,544	2.
Mar. 12	11,071	882	10,189	2.
26	11,524	943	10,581	2.
Dec. 11	12,988	921	12,067	2.
Nov. 27	13,679	620	13,059	2.
Apr. 2	13,724	896	12,828	2.
Mar. 19	15,904	1,164	14,740	3.
Apr. 9	17,060	1,097	15,963	3.
May 7	19,931	165	19,766	4.
Apr. 16	28,971	1,065	27,906	6.
30	29,256	343	28,913	6.
23	33,512	719	32,793	7.
The year	7,988	331	7,657	1.

t River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

in second-feet.	
From net drainage basins.	Per square mile of net drainage area.
1,264	0.284
1,448	.325
1,529	.343
1,621	.364
1,629	.366
1,640	.368
1,672	.376
1,704	.383
1,748	.393
1,803	.405
1,828	.411
1,845	.414
1,862	.418
1,915	.430
1,933	.434
1,947	.437
2,009	.451
2,067	.464
2,093	.470
2,197	.493
2,208	.496
2,253	.506
2,384	.535
2,424	.544
2,533	.569
2,623	.589
2,681	.602
2,920	.656
2,974	.668
3,073	.690
3,131	.703
,246	.729
,672	.825
,347	.976
,498	1.235
,858	1.316
,334	1.423
,616	1.486
,406	1.888
,492	2.132
,169	2.509
,162	2.507
,629	2.387
,080	2.713
,621	3.509
,480	3.477
553	3.493
392	3.682
296	3.660
473	4.374
334	5.241
662	5.764
647	6.435
414	1.440

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1900–1901.				
Oct. 7	1,931	7	1,924	0.432
Nov. 4	2,100	7	2,093	.470
Mar. 3	2,271	9	2,262	.508
Oct. 28	2,287	7	2,280	.512
Feb. 17	2,359	26	2,333	.524
Sept. 29	2,401	30	2,371	.533
Feb. 24	2,422	13	2,409	.541
10	2,499	24	2,475	.556
July 7	2,550	11	2,539	.570
28	2,565	11	2,554	.574
Sept. 15	2,591	38	2,553	.574
Mar. 10	2,686	13	2,673	.600
Sept. 8	2,746	43	2,703	.607
Oct. 21	2,831	8	2,823	.634
Sept. 22	2,879	46	2,833	.636
Feb. 3	2,936	24	2,912	.654
Oct. 14	2,969	10	2,959	.665
July 21	2,977	11	2,966	.666
Jan. 13	3,211	30	3,181	.715
July 14	3,215	11	3,204	.720
Jan. 27	3,277	28	3,249	.730
Aug. 25	3,304	51	3,253	.731
Jan. 20	3,383	33	3,350	.752
Aug. 4	3,650	51	3,599	.808
June 30	3,833	26	3,807	.855
Jan. 6	3,906	37	3,869	.869
Sept. 1	3,925	73	3,852	.865
Dec. 23	3,947	39	3,908	.878
June 23	4,245	28	4,217	.947
Aug. 18	4,651	26	4,625	1.039
Nov. 25	5,157	9	5,148	1.156
11	5,178	10	5,168	1.161
18	5,335	9	5,326	1.196
Dec. 16	5,660	93	5,567	1.250
30	5,917	44	5,873	1.319
Aug. 11	5,954	41	5,913	1.328
June 16	7,358	86	7,272	1.633
Mar. 17	9,474	350	9,124	2.049
24	9,510	362	9,148	2.055
May 12	10,480	483	9,997	2.246
Dec. 2	10,760	202	10,558	2.372
9	11,399	524	10,875	2.443
June 9	11,684	297	11,387	2.558
May 19	11,689	526	11,163	2.507
5	15,797	714	15,083	3.388
Apr. 21	16,966	540	16,426	3.690
Mar. 31	19,744	703	19,041	4.277
June 2	20,221	1,120	19,101	4.290
May 26	21,258	938	20,320	4.564
Apr. 7	22,439	1,605	20,834	4.680
28	25,445	1,697	23,748	5.334
14	41,490	1,269	40,221	9.034
The year	7,490	238	7,252	1.629

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 30 1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.				Week ending Sunday.	Mean discharge in second-feet			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1901–2.					1902–3.				
Sept. 7	2,382	6	2,376	0.534	June 7	1,823	4	1,819	0.40
Oct. 13	2,387	31	2,356	.529	Sept. 27	2,194	11	2,183	.49
6	2,463	34	2,429	.546	20	2,240	17	2,223	.49
Nov. 10	2,846	59	2,787	.626	13	2,385	16	2,369	.53
Dec. 8	2,892	62	2,830	.636	May 31	2,482	4	2,478	.55
Aug. 10	2,921	6	2,915	.655	Sept. 6	2,879	14	2,865	.64
Nov. 17	2,993	44	2,949	.662	Aug. 23	2,917	16	2,901	.65
3	3,102	40	3,062	.688	30	3,139	25	3,114	.69
24	3,116	68	3,048	.685	July 19	3,150	14	3,136	.70
July 20	3,272	8	3,264	.733	Aug. 16	3,426	49	3,377	.75
Sept. 14	3,347	6	3,341	.750	May 24	3,607	6	3,601	.80
Dec. 1	3,407	102	3,305	.742	Aug. 9	3,736	212	3,524	.79
Aug. 24	3,457	6	3,451	.775	2	3,978	26	3,952	.88
3	3,478	6	3,472	.780	July 12	4,036	35	4,001	.89
31	3,486	12	3,474	.780	Dec. 14	4,190	58	1,132	.92
Sept. 28	3,516	7	3,509	.788	June 14	4,335	5	4,330	.973
Feb. 23	3,937	141	3,796	.853	Nov 30	4,372	45	4,327	.972
Sept. 21	3,960	7	3,953	.888	May 17	4,590	7	4,583	1.02
Oct. 27	4,057	38	4,019	.903	Nov. 23	4,929	53	4,876	1.095
July 13	4,062	9	4,053	.910	Dec. 7	4.948	61	4,887	1.098
June 15	4,393	8	4,385	.985	Oct. 26	5,090	6	5,084	1.142
Feb. 16	4,708	96	4,612	1.036	19	5,225	6	5,219	1.172
May 25	5,103	9	5,094	1.144	Nov. 16	5,399	7	5,392	1.211
July 27	5,116	7	5,109	1.148	May 10	5,805	9	5,796	1.302
6	5,182	7	5,175	1.162	July 26	5,818	48	5,770	1.296
June 29	5,325	8	5,317	1.194	Oct. 12	6,622	7	6,615	1.486
22	5,393	8	5,385	1.210	Jan. 18	6,699	122	6,577	1.477
Jan. 19	5,547	126	5,421	1.218	Nov. 9	6,831	14	6,817	1.531
June 8	5,618	9	5,609	1.260	May 3	7,055	36	7,019	1.577
Aug. 17	5,679	6	5,673	1.274	Oct. 5	7,085	6	7,079	1.590
Dec. 15	5,683	667	5,016	1.127	Jan. 25	7,205	170	7,035	1.580
May 18	6,914	22	6,892	1.548	July 5	7,261	159	7,102	1.595
Feb. 9	7,108	220	6,888	1.547	Feb. 1	7,470	278	7,192	1.615
Jan. 12	7,445	209	7,236	1.625	Dec. 21	8,174	322	7,852	1.764
Dec. 29	7,537	397	7,140	1.604	Feb. 22	8,707	324	8,383	1.883
Oct. 20	7,814	174	7,640	1.716	Jan. 4	8,748	275	8,473	1.903
June 1	10,008	42	9,966	2.239	11	9,230	210	9,020	2.026
Feb. 2	10,097	426	9,671	2.172	Mar. 1	10,139	664	9,475	2.128
Apr. 27	10,918	209	10,709	2.405	Feb. 15	10,435	630	9,805	2.202
Jan. 26	12,555	535	12,020	2.700	8	10,487	553	9,934	2.231
May 11	12,581	203	12,378	2.780	Apr. 26	10,850	294	10,556	2.371
Mar. 2	15.229	1,956	13,273	2.981	Nov. 2	12,386	163	12,223	2.746
Apr. 20	15,694	360	15,334	3.444	June 21	13,146	549	12,597	2.830
May 4	17,970	415	17,555	3.943	Dec. 28	14,683	779	13,904	3.123
Jan. 5	18,762	1,217	17,545	3.941	Apr. 19	15,947	663	15,284	3.433
Mar. 30	19,710	398	19,312	4.338	12	19,641	865	18,776	4.217
Dec. 22	20,794	717	20,077	4.510	Mar. 8	21,205	561	20,644	4.637
Apr. 6	21,367	367	21,000	4.717	Apr. 5	21,884	856	21,028	4.723
13	24,678	1,057	23,621	5.306	June 28	22,110	1,081	21,029	4.723
Mar. 16	25,204	1,202	24,002	5.391	Mar. 22	24,347	364	23,983	5.387
23	27,235	938	26,297	5.907	29	31,265	1,140	30,125	6.767
9	36,144	1,022	35,122	7.889	15	36,221	1,049	35,172	7.900
The year	8,819	264	8,555	1.922	The year	8,895	248	8,647	1.942

ck River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

ge in second-feet.		Week ending Sunday.	Mean discharge in second-feet.			
From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
		1904–5.				
1,882	0.423	Dec. 25	1,540	5	1,535	0.345
2,076	.466	18	1,663	5	1,658	.372
2,081	.467	Jan. 1	1,929	5	1,924	.432
2,092	.470	Dec. 11	1,965	5	1,960	.440
2,169	.487	July 30	1,971	6	1,965	.441
2,182	.490	Mar. 5	2,151	5	2,146	.482
2,219	.498	Feb. 26	2,181	6	2,175	.489
2,260	.508	19	2,250	45	2,205	.495
2,332	.524	Aug. 13	2,255	5	2,250	.505
2,471	.555	July 23	2,303	6	2,297	.516
2,473	.556	Aug. 27	2,318	6	2,312	.519
2,542	.571	Feb. 12	2,345	45	2,300	.517
2,573	.578	Dec. 4	2,366	6	2,360	.530
2,597	.583	Nov. 13	2,426	7	2,419	.543
2,571	.578	Sept. 3	2,507	36	2,471	.555
2,586	.581	Feb. 5	2,557	40	2,517	.565
2,662	.598	July 16	2,558	6	2,552	.573
2,704	.607	Mar. 12	2,606	15	2,591	.582
2,691	.604	Nov. 20	2,738	7	2,731	.613
2,738	.615	27	2,738	5	2,733	.614
2,735	.614	Jan. 29	2,849	44	2,805	.630
2,867	.644	Oct. 16	2,852	6	2,846	.639
2,870	.645	June 4	2,877	6	2,871	.645
3,089	.694	Nov. 6	2,935	11	2,924	.657
3,224	.724	Jan. 8	3,111	52	3,059	.687
3,313	.744	Aug. 20	3,149	6	3,143	.706
3,439	.772	June 11	3,152	9	3,143	.706
3,443	.773	Aug. 6	3,167	6	3,161	.710
3,561	.800	Oct. 23	3,414	6	3,408	.766
3,539	.795	June 18	3,423	23	3,400	.764
3,569	.802	Oct. 9	3,448	5	3,443	.773
3,728	.837	July 9	3,782	5	3,777	.849
3,770	.847	Jan. 22	3,892	69	3,823	.858
4,051	.910	Mar. 19	3,957	84	3,873	.870
4,130	.928	Oct. 2	3,989	5	3,984	.895
4,693	1.054	May 28	4,077	12	4,065	.913
5,172	1.162	Oct. 30	4,341	5	4,336	.974
6,227	1.398	July 2	5,180	10	5,170	1.161
6,339	1.424	May 14	5,502	10	5,492	1.234
6,754	1.517	June 25	5,616	41	5,575	1.252
8,151	1.831	May 21	5,758	28	5,730	1.287
10,684	2.400	Sept. 17	5,771	6	5,765	1.295
11,712	2.631	Jan. 15	6,213	112	6,101	1.370
13,902	3.123	May 7	6,292	6	6,286	1.412
4,015	3.148	Apr. 30	8,060	27	8,033	1.804
5,711	3.529	23	9,868	59	9,809	2.203
8,968	4.261	Mar. 26	10,089	178	9,911	2.226
0,115	4.519	Sept. 24	10,333	9	10,324	2.319
2,458	5.044	10	11,484	64	11,420	2.565
3,772	5.340	Apr. 16	16,864	115	16,749	3.762
4,617	5.530	9	22,836	151	22,685	5.095
5,489	5.725	2	40,479	218	40,261	9.043
6,500	1.460	The year	5,272	32	5,240	1.177

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 3 1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1905–6.				
Sept. 23	1,745	8	1,737	0.390
16	1,804	8	1,796	.403
30	1,890	8	1,882	.423
9	2,145	8	2,137	.480
Aug. 26	2,419	10	2,409	.541
Sept. 2	2,567	9	2,558	.575
Aug. 19	2,753	15	2,738	.615
Nov. 5	2,806	5	2,801	.629
26	2,890	5	2,885	.648
Oct. 8	3,126	72	3,054	.686
15	3,220	9	3,211	.721
29	3,259	5	3,254	.731
22	3,368	7	3,361	.755
Nov. 19	3,490	5	3,485	.783
Feb. 18	3,510	32	3,478	.781
Dec. 3	3,542	6	3,536	.794
Feb. 11	3,561	42	3,519	.790
July 22	3,618	18	3,600	.809
Aug. 12	3,657	37	3,620	.813
July 29	3,770	8	3,762	.845
Dec. 17	4,013	6	4,007	.900
Mar. 25	4,246	128	4,118	.925
Oct. 1	4,376	54	4,322	.971
Dec. 24	4,452	5	4,447	.999
July 15	4,456	29	4,427	.994
Nov. 12	4,691	5	4,686	1.053
Jan. 14	4,706	55	4,651	1.045
Aug. 5	4,948	9	4,939	1.110
May 27	5,344	12	5,332	1.198
Dec. 31	5,529	49	5,480	1.231
Mar. 18	5,608	169	5,439	1.222
Jan. 21	5,893	76	5,817	1.307
Feb. 25	5,981	110	5,871	1.319
4	6,181	59	6,122	1.375
Jan. 7	6,408	82	6,326	1.421
June 17	7,301	27	7,274	1.634
May 20	7,524	18	7,506	1.686
July 8	7,990	61	7,929	1.781
Mar. 4	8,390	148	8,242	1.851
May 6	8,406	14	8,392	1.885
July 1	8,458	23	8,435	1.895
May 13	8,782	14	8,768	1.969
Dec. 10	9,371	6	9,365	2.104
Mar. 11	10,181	248	9,933	2.231
June 10	10,697	51	10,646	2.391
24	10,896	33	10,863	2.440
Apr. 29	11,531	86	11,445	2.571
1	12,315	351	11,964	2.687
Jan. 28	13,675	84	13,591	3.053
Apr. 8	13,936	170	13,766	3.092
15	16,669	281	16,388	3.681
June 3	22,983	181	22,802	5.122
Apr. 22	23,646	167	23,479	5.274
The year	6,580	59	6,521	1.465

Week ending Sunday.	Mean discharge in second-feet			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1906–7.				
Sept. 1	1,245	5	1,240	0.27
Aug. 25	1,684	7	1,677	.37
Oct. 7	1,859	8	1,851	.41
14	1,954	10	1,944	.43
Sept. 8	2,042	7	2,035	.45
Aug. 18	2,113	7	2,106	.47
Sept. 22	2,321	8	2,313	.51
Oct. 21	2,327	8	2,319	.52
Dec. 16	2,405	7	2,398	.53
Nov. 11	2,453	7	2,446	.54
Aug. 11	2,454	7	2,447	.55
Dec. 9	2,518	7	2,511	.56
23	2,596	77	2,519	.56
Aug. 4	2,602	8	2,594	.58
Dec. 30	2,632	46	2,586	.58
Mar. 10	2,684	60	2,624	.58
Sept. 15	2,701	8	2,693	.60
Mar. 3	2,714	67	2,647	.59
July 28	2,721	8	2,713	.60
Nov. 18	2,748	36	2,712	.60
Feb. 24	2,927	62	2,865	.64
Nov. 4	2,980	7	2,973	.66
Oct. 28	3,031	7	3,024	.67
Feb. 17	3,039	92	2,947	.66
June 30	3,101	10	3,091	.69
July 21	3,159	7	3,152	.70
Feb. 10	3,181	110	3,071	.69
Dec. 2	3,327	10	3,317	.74
Mar. 17	3,458	80	3,378	.75
July 14	3,468	8	3,460	.77
June 23	3,522	15	3,507	.78
Feb. 3	3,568	78	3,490	.78
Sept. 29	3,842	8	3,834	.86
July 7	3,972	7	3,965	.89
Jan. 20	4,240	85	4,155	.93
Nov. 25	4,347	35	4,312	.96
Jan. 27	4,380	92	4,288	.96
June 2	5,932	71	5,861	1.31
16	6,063	49	6,014	1.35
May 26	7,480	59	7,421	1.66
Jan. 6	8,767	202	8,565	1.92
June 9	8,931	138	8,793	1.97
Jan. 13	9,152	124	9,028	2.02
May 12	9,253	64	9,189	2.06
19	9,271	75	9,196	2.06
Apr. 14	10,937	167	10,770	2.41
Mar. 24	11,093	178	10,915	2.45
Apr. 21	11,336	145	11,191	2.51
28	12,394	112	12,282	2.75
May 5	14,036	91	13,945	3.13
Mar. 31	16,475	119	16,356	3.67
Apr. 7	17,397	97	17,300	3.88
The year	5,093	54	5,039	1.13

ck River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

ge in second-feet.				Mean discharge in second-feet.			
	From net drainage basins.	Per square mile of net drainage area.	Week ending Sunday.	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
			1908–9.				
7	1,239	0.278	Sept. 5	1,321	5	1,316	0.296
3	1,726	.388	Nov. 1	1,365	8	1,357	.305
7	1,762	.396	Dec. 27	1,418	11	1,407	.316
8	1,814	.407	Oct. 11	1,463	7	1,456	.327
6	2,043	.459	4	1,464	7	1,457	.327
8	2,143	.481	Sept. 26	1,468	6	1,462	.328
8	2,212	.497	Nov. 29	1,475	9	1,466	.329
7	2,249	.505	Oct. 25	1,480	7	1,473	.331
9	2,398	.539	18	1,497	7	1,490	.335
7	2,420	.544	Sept. 12	1,592	7	1,585	.356
3	2,691	.604	Nov. 15	1,614	19	1,595	.358
7	2,771	.622	22	1,618	9	1,609	.361
6	2,828	.635	Aug. 22	1,651	8	1,643	.369
8	3,207	.720	Sept. 19	1,661	7	1,654	.372
31	3,555	.799	Aug. 15	1,687	8	1,679	.377
16	3,890	.874	Nov. 8	1,699	23	1,676	.376
8	3,974	.893	Aug. 8	1,789	7	1,782	.400
8	4,121	.926	29	1,849	8	1,841	.414
09	4,198	.943	1	1,870	7	1,863	.418
93	5,397	1.212	July 18	1,884	7	1,877	.422
57	5,802	1.303	Jan. 3	1,888	14	1,874	.421
19	5,911	1.328	July 25	1,909	7	1,902	.427
76	5,883	1.321	Dec. 13	1,963	25	1,938	.435
43	6,163	1.384	6	1,979	8	1,971	.443
55	6,364	1.430	20	2,057	19	2,038	.458
252	6,331	1.422	July 11	2,146	7	2,139	.480
9	6,755	1.517	Jan. 24	2,338	7	2,331	.524
228	7,287	1.637	July 4	2,427	9	2,418	.543
77	7,526	1.690	Feb. 7	2,657	22	2,635	.592
160	8,011	1.799	Jan. 31	2,933	7	2,926	.657
144	8,233	1.849	17	3,328	7	3,321	.746
8	8,707	1.955	June 27	3,728	11	3,717	.835
100	8,635	1.940	Jan. 10	4,231	21	4,210	.946
95	8,651	1.943	June 20	4,259	25	4,234	.951
167	9,504	2.135	6	4,525	58	4,467	1.003
96	9,765	2.193	13	5,194	24	5,170	1.161
138	10,502	2.359	Mar. 21	5,207	114	5,093	1.144
209	10,906	2.450	Feb. 21	5,238	199	5,039	1.132
143	11,179	2.511	14	5,316	101	5,215	1.171
209	11,328	2.544	May 30	5,607	72	5,535	1.246
152	11,686	2.625	Mar. 14	6,003	154	5,849	1.314
104	12,435	2.793	7	8,011	168	7,843	1.762
11	12,633	2.838	May 23	8,391	88	8,303	1.865
134	12,623	2.836	16	9,506	102	9,404	2.112
192	13,202	2.965	Mar. 28	9,936	228	9,708	2.181
116	13,669	3.070	Apr. 4	10,437	186	10,251	2.303
286	13,594	3.053	May 9	11,243	120	11,123	2.498
117	15,237	3.422	2	11,904	183	11,721	2.633
29	15,520	3.486	Apr. 11	13,536	117	13,419	3.014
327	15,413	3.462	Feb. 28	15,261	322	14,939	3.353
404	16,529	3.713	Apr. 25	18,352	158	18,194	4.087
85	22,893	5.142	18	19,737	207	19,530	4.387
98	7,606	1.708	The year	4,675	57	4,618	1.037

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 30 1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.				Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1909-10.					1910-11.				
Sept. 4	1,279	5	1,274	0.286	July 23	854	6	848	0.19
Nov. 21	1,472	9	1,463	.329	9	985	6	979	.220
Oct. 24	1,520	5	1,515	.340	Dec. 18	1,131	10	1,121	.25
Nov. 28	1,563	19	1,544	.347	25	1,187	24	1,163	.261
July 24	1,577	6	1,571	.353	Aug. 20	1,211	6	1,205	.271
31	1,619	5	1,614	.363	Oct. 30	1,251	5	1,246	.28
Nov. 14	1,623	10	1,613	.362	Aug. 27	1,268	6	1,262	.28
Sept. 25	1,633	5	1,628	.366	July 30	1,322	6	1,316	.29
Jan. 9	1,652	50	1,602	.360	Oct. 23	1,332	8	1,324	.297
Oct. 17	1,725	4	1,721	.387	Aug. 13	1,409	6	1,403	.31
Nov. 7	1,741	35	1,706	.383	Oct. 16	1,451	4	1,447	.32
Jan. 2	1,752	15	1,737	.390	Nov. 27	1,484	11	1,473	.331
Oct. 31	1,779	19	1,760	.395	Oct. 9	1,487	6	1,481	.33
Sept. 18	1,860	5	1,855	.417	July 16	1,558	7	1,551	.34
July 10	1,918	25	1,893	.425	Dec. 11	1,572	17	1,555	.34
Aug. 28	1,948	5	1,943	.436	Oct. 2	1,614	5	1,609	.361
Sept. 11	1,997	5	1,992	.447	Nov. 6	1,619	12	1,607	.361
Oct. 10	2,004	4	2,000	.449	Sept. 10	1,811	3	1,808	.40
July 17	2,027	5	2,022	.454	Dec. 4	1,851	16	1,835	.412
Aug. 21	2,050	5	2,045	.459	Sept. 3	1,859	6	1,853	.416
14	2,063	5	2,058	.462	Feb. 19	1,869	8	1,861	.418
Jan. 16	2,116	63	2,053	.461	Aug. 6	1,881	6	1,875	.421
Dec. 12	2,150	18	2,132	.479	July 2	1,922	5	1,917	.431
26	2,161	21	2,140	.481	Sept. 17	1,937	6	1,931	.434
Aug. 7	2,382	6	2,376	.534	Feb. 26	1,940	17	1,923	.432
Dec. 5	2,598	19	2,579	.579	Jan. 1	1,948	35	1,913	.430
19	2,640	39	2,601	.584	29	1,989	28	1,961	.440
July 3	2,749	59	2,690	.604	Sept. 24	2,008	4	2,004	.450
Oct. 3	2,821	11	2,810	.631	Nov. 20	2,056	9	2,047	.460
Feb. 20	3,730	148	3,582	.805	June 25	2,097	5	2,092	.470
13	3,789	109	3,680	.827	Jan. 22	2,217	19	2,198	.494
June 26	4,415	96	4,319	.970	Mar. 12	2,227	9	2,218	.498
5	4,421	20	4,401	.989	Feb. 12	2,411	18	2,393	.538
Jan. 23	4,897	180	4,717	1.060	5	2,572	28	2,544	.571
May 29	4,968	22	4,946	1.111	June 4	2,643	6	2,637	.592
June 12	4,977	51	4,926	1.106	11	2,655	10	2,645	.594
Feb. 6	5,118	125	4,993	1.122	Mar. 5	2,707	14	2,693	.605
27	5,209	220	4,989	1.121	June 18	2,924	9	2,915	.655
May 22	5,222	31	5,191	1.166	Nov. 13	2,947	39	2,908	.653
June 19	6,439	144	6,295	1.414	Jan. 15	2,988	36	2,952	.663
Apr. 17	6,459	131	6,328	1.421	May 28	3,250	9	3,241	.728
May 15	6,558	13	6,545	1.470	21	4,124	7	4,117	.925
Apr. 24	9,248	100	9,148	2.055	Jan. 8	4,159	62	4,097	.920
May 8	10,117	55	10,062	2.260	Mar. 26	4,548	29	4,519	1.015
Mar. 20	11,085	135	10,950	2.460	19	6,049	73	5,976	1.342
Jan. 30	11,185	198	10,960	2.462	May 14	6,162	9	6,153	1.382
Apr. 10	11,994	75	11,919	2.677	7	11,904	9	11,895	2.672
Mar. 27	13,324	133	13,191	2.963	Apr. 9	11,947	61	11,886	2.670
May 1	14,182	95	14,087	3.164	30	12,363	23	12,340	2.772
Apr. 3	16,570	111	16,459	3.697	23	14,164	18	14,146	3.177
Mar. 13	17,781	257	17,524	3.934	2	14,205	22	14,183	3.186
6	21,557	517	21,040	4.726	16	15,657	43	15,614	3.507
The year	4,994	66	4,928	1.107	The year	3,514	16	3,498	.786

ack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

arge in second-feet.		
drainage basins.	From net drainage basins.	Per square mile of net drainage area.
5	1,599	0.359
4	1,727	.388
5	1,735	.390
5	1,743	.392
7	1,846	.415
5	1,881	.423
5	1,949	.438
5	2,015	.453
7	2,090	.469
6	2,104	.473
7	2,119	.476
5	2,272	.510
5	2,485	.558
7	2,551	.573
5	2,632	.591
4	2,697	.606
27	2,731	.613
4	2,831	.636
6	2,881	.647
16	2,948	.662
16	3,119	.701
23	3,189	.716
5	3,301	.741
47	3,268	.734
89	3,518	.790
6	3,677	.826
26	3,818	.858
15	3,951	.887
5	4,127	.927
25	4,139	.930
124	4,200	.943
20	4,623	1.038
9	4,643	1.043
20	4,837	1.086
6	4,863	1.092
31	5,510	1.238
32	5,738	1.289
48	5,823	1.308
9	6,423	1.443
57	8,321	1.869
117	9,461	2.125
177	9,500	2.154
56	10,176	2.286
239	10,702	2.404
278	11,417	2.564
308	11,771	2.644
439	12,538	2.816
282	15,358	3.450
133	15,750	3.538
196	19,558	4.393
350	21,736	4.982
176	22,058	4.955
314	22,147	4.975
73	6,313	1.418

Week ending Sunday.	Mean discharge in second-feet.			
	Measured at Lawrence (total drainage area, 4,663 square miles.	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1912-13.				
Aug. 31	1,130	10	1,120	0.252
Sept. 21	1,228	11	1,217	.273
14	1,442	5	1,437	.323
Aug. 3	1,462	10	1,452	.326
17	1,465	8	1,457	.327
24	1,471	17	1,454	.327
July 27	1,514	8	1,506	.338
Aug. 10	1,559	8	1,551	.348
Sept. 7	1,629	10	1,619	.364
July 6	1,704	6	1,698	.381
Oct. 13	1,885	5	1,880	.422
July 20	1,894	7	1,887	.424
13	2,029	8	2,021	.454
Oct. 20	2,100	9	2,091	.470
6	2,101	5	2,096	.471
Sept. 28	2,462	16	2,446	.549
June 29	2,488	12	2,476	.556
22	2,659	18	2,641	.593
15	3,436	34	3,402	.764
Feb. 16	3,521	43	3,478	.781
23	3,640	68	3,572	.802
May 18	3,795	30	3,765	.846
Dec. 29	3,913	31	3,882	.872
1	4,483	30	4,453	1.000
22	4,546	21	4,525	1.016
Nov. 24	4,804	12	4,792	1.076
Dec. 15	4,805	15	4,790	1.076
Nov. 3	5,032	5	5,027	1.129
Feb. 9	5,077	71	5,006	1.124
May 25	5,120	90	5,030	1.130
Mar. 9	5,211	129	5,082	1.142
Oct. 27	5,212	5	5,207	1.170
May 11	5,305	52	5,253	1.180
Mar. 2	5,597	130	5,467	1.228
Dec. 8	5,702	37	5,665	1.272
Feb. 2	6,199	86	6,113	1.373
Nov. 10	6,456	9	6,447	1.448
June 8	6,668	47	6,621	1.487
Jan. 19	6,847	114	6,733	1,512
Nov. 17	6,884	16	6,868	1.543
May 4	7,885	114	7,771	1.746
Jan. 12	7,973	110	7,863	1.766
Apr. 27	8,032	153	7,879	1.770
Jan. 26	8,876	104	8,772	1.970
5	8,937	104	8,833	1.984
Mar. 16	10,152	150	10,002	2.247
Apr. 13	10,772	216	10,556	2.371
June 1	11,922	128	11,794	2.649
Apr. 20	12,499	344	12,155	2.730
6	16,370	224	16,146	3.627
Mar. 23	21,190	149	21,041	4.726
30	26,447	315	26,132	5.870
The year	5,683	65	5,618	1.262

Weekly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Week ending Sunday.	Mean discharge in second-feet.				Week ending Sunday.	Mean discharge in second-feet			
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.		Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage basins.	Per square mile of net drainage area.
1913–14.					1914–15.				
Sept. 27	1,621	8	1,613	0.362	Oct. 18	1,145	7	1,138	0.256
Aug. 16	1,753	10	1,743	.392	3	1,348	8	1,340	.301
Sept. 20	1,761	8	1,753	.394	Nov. 15	1,372	29	1,343	.302
Aug. 2	1,842	12	1,830	.411	Oct. 11	1,375	8	1,367	.307
9	1,904	14	1,890	.425	Nov. 8	1,407	26	1,381	.310
Sept. 13	2,017	8	2,009	.451	1	1,408	10	1,398	.314
Aug. 23	2,035	29	2,006	.451	Dec. 27	1,452	30	1,422	.319
Oct. 5	2,120	18	2,102	.472	Oct. 25	1,469	8	1,461	.328
July 26	2,155	8	2,147	.482	Jan. 3	1,599	28	1,571	.353
Oct. 19	2,210	19	2,191	.492	Nov. 29	1,778	27	1,751	.393
Aug. 30	2,263	12	2,251	.506	June 20	1,890	10	1,880	.422
June 28	2,463	8	2,455	.551	Nov. 22	1,918	31	1,887	.424
Oct. 12	2,473	12	2,461	.553	June 13	1,929	10	1,919	.431
July 5	2,484	23	2,461	.553	Dec. 20	2,091	39	2,052	.461
19	2,689	20	2,669	.600	6	2,203	29	2,174	.488
June 22	2,691	8	2,683	.603	13	2,268	31	2,237	.502
Jan. 25	2,756	95	2,661	.598	June 27	2,304	9	2,295	.515
18	2,821	87	2,734	.614	6	2,506	11	2,495	.560
Sept. 6	2,871	8	2,863	.643	Sept. 19	2,552	12	2,540	.571
July 12	2,984	20	2,964	.666	12	2,726	19	2,707	.608
Nov. 9	3,487	32	3,455	.776	26	2,805	19	2,786	.626
Mar. 1	3,517	210	3,307	.743	Jan. 10	2,872	66	2,806	.630
Jan. 11	3,523	100	3,423	.769	May 30	2,983	16	2,967	.666
Nov. 30	3,524	57	3,467	.779	Feb. 7	3,362	150	3,212	.721
Feb. 22	3,607	112	3,495	.785	May 23	3,653	21	3,632	.816
June 14	3,694	6	3,688	.828	Jan. 17	3,897	145	3,752	.843
Jan. 4	3,752	99	3,653	.821	Sept. 5	4,013	24	3,989	.896
Nov. 23	4,093	46	4,047	.909	July 4	4,094	105	3,989	.896
Dec. 7	4,110	67	4,043	.908	Feb. 14	4,250	196	4,054	.911
28	4,159	117	4,042	.908	July 25	4,535	51	4,484	1.007
21	4,265	54	4,211	.946	Mar. 21	4,677	33	4,644	1.043
Feb. 15	4,354	107	4,247	.954	Apr. 4	4,784	27	4,757	1.069
June 7	4,418	23	4,395	.987	May 16	5,051	20	5,031	1.130
Oct. 26	4,473	38	4,435	.996	Jan. 31	5,109	153	4,956	1.113
Feb. 1	4,802	222	4,580	1.029	Mar. 28	5,170	30	5,140	1.155
May 31	5,629	49	5,580	1.253	Aug. 1	5,494	45	5,449	1.224
Feb. 8	6,011	219	5,792	1.301	Mar. 14	6,038	70	5,968	1.341
Nov. 2	6,193	63	6,130	1.377	Apr. 11	6,549	43	6,506	1.461
Dec. 14	6,420	72	6,348	1.426	25	6,644	22	6,622	1.487
Nov. 16	6,486	47	6,439	1.446	Feb. 21	6,800	264	6,536	1.468
Mar. 22	8,485	151	8,334	1.872	Aug. 22	6,820	59	6,761	1.519
May 24	9,382	88	9,294	2.088	May 2	7,301	33	7,268	1.633
Mar. 15	12,074	240	11,834	2.658	Aug. 29	7,337	48	7,289	1.637
29	12,177	123	12,054	2.708	May 9	7,745	35	7,710	1.732
May 1	14,968	280	14,688	3.299	July 18	9,191	76	9,115	2.047
10	17,879	262	17,617	3.957	Jan. 24	9,701	341	9,360	2.102
Apr. 19	18,201	253	17,948	4.031	Mar. 7	11,318	147	11,171	2.509
12	20,694	360	20,334	4.567	Aug. 15	11,704	131	11,573	2.600
May 3	24,029	333	23,696	5.323	8	13,185	245	12,940	2.907
Apr. 26	24,042	194	23,848	5.357	Apr. 18	13,896	14	13,882	3.118
Mar. 8	24,544	544	24,000	5.391	July 11	14,638	167	14,471	3.250
Apr. 5	26,003	335	25,668	5.765	Feb. 28	17,485	258	17,227	3.869
The year	6,710	102	6,608	1.484	The year	4,997	66	4,931	1.108

mack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915.

Mean discharge in second-feet.				Run-off.		Rainfall in inches.
easured at Lawrence (total drainage area, 4,663 square miles.)[a]	Wasting into Merrimack River from diverted drainage basins.[b]	From net drainage area.[c]	Per square mile of net drainage area.[c]	Depth in inches on drainage area.[c]	Per cent of rainfall.	
2,445	4	2,441	0.534	0.62	50.5	1.22
4,338	3	4,335	949	1.06	27.9	3.80
7,038	3	7,035	1.540	1.78	45.8	3.88
7,475	84	7,391	1.618	1.87	47.2	3.95
12,449	179	12,270	2.687	2.90	111.4	2.60
10,620	151	10,469	2.292	2.64	134.1	1.97
10,878	111	10,767	2.358	2.63	91.6	2.87
5,557	35	5,522	1.209	1.39	61.7	2.26
3,183	3	3,180	.696	.78	35.5	2.19
2,952	3	2,949	.646	.74	15.6	4.77
2,535	4	2,531	.554	.64	25.6	2.50
2,241	3	2,238	.490	.55	21.4	2.56
5,976	49	5,927	1.298	17.60	50.9	34.57
1,773	3	1,770	.388	.45	10.8	4.13
4,244	3	4,241	.929	1.04	36.9	2.81
2,649	3	2,646	.580	.67	28.2	2.37
2,304	2	2,302	.504	.58	14.7	3.96
4,792	100	4,692	1.027	1.07	30.4	3.52
17,106	465	16,641	3.641	4.20	97.6	4.30
16,197	152	16,045	3.511	3.92	279.8	1.40
14,249	79	14,170	3.101	3.57	84.7	4.22
5,131	130	5,001	1.094	1.22	37.9	3.22
3,447	13	3,434	.751	.87	18.6	4.66
2,794	2	2,792	.611	.70	36.7	1.92
2,513	2	2,511	.549	.61	20.2	3.03
6,433	80	6,353	1.390	18.90	47.8	39.54
2,494	2	2,492	.545	.63	18.3	3.43
5,301	12	5,289	1.157	1.29	36.7	3.52
8,407	33	8,374	1.832	2.11	38.3	5.51
7,432	104	7,328	1.604	1.85	50.8	3.64
9,456	245	9,211	2.016	2.10	48.9	4.29
16,248	330	15,918	3.483	4.02	130.9	3.07
10,405	42	10,363	2.268	2.53	190.2	1.33
10,728	124	10,604	2.320	2.67	56.3	4.75
9,013	42	8,971	1.963	2.19	61.2	3.58
3,142	2	3,140	.687	.79	31.9	2.48
2,151	2	2,149	.470	.54	55.9	.97
3,716	3	3,713	.812	.91	11.4	7.96
7,374	78	7,296	1.596	21.63	48.6	44.53
3,099	2	3,097	.678	.78	49.4	1.58
2,310	3	2,307	.505	.56	55.8	1.01
2,161	3	2,158	.472	.54	20.5	2.66
2,024	2	2,022	.442	.51	20.2	2.53
2,944	47	2,897	.634	.66	17.5	3.77
4,090	156	3,934	.861	.99	56.7	1.75
15,535	80	15,455	3.382	3.77	167.7	2.25
8,540	68	8,472	1.854	2.14	54.9	3.89
5,040	11	5,029	1.100	1.23	36.1	3.40
3,127	2	3,125	.684	.79	16.1	4.89
1,933	2	1,931	.423	.49	39.6	1.23
1,219	2	1,217	.266	.30	12.3	2.42
4,335	32	4,303	.942	12.76	40.7	31.38

n Lake Cochituate drainage basin was diverted to Charles River, thus arti-
area 1 square mile. Prior to July, 1909, the total drainage area was 4,664

iverted drainage area from which discharge wasted into the Merrimac was
to Mar. 6, 1898, 94 square miles; Mar. 7, 1898, to June 30, 1909, 212 square
, 1915, 211 square miles.

et drainage area was 4,567 square miles; Jan. 1, 1881, to Mar. 6, 1898, 4,570
Sept. 30, 1915, 4,452 square miles.

Monthly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. *1880–1915*—Continued.

Month.	Mean discharge in second-feet.				Run-off.		Rainf in inch
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
1883–84.							
October	1,975	2	1,973	0.432	0.50	10.7	4.
November	2,868	2	2,866	.627	.70	32.2	2.
December	2,355	2	2,353	.515	.59	20.5	2.
January	4,662	6	4,656	1.019	1.17	28.6	4.
February	9,609	224	9,385	2.054	2.22	41.1	5.
March	15,742	481	15,261	3.339	3.85	82.6	4.
April	26,199	352	25,847	5.656	6.31	178.3	3.
May	11,922	109	11,813	2.585	2.98	85.1	3.
June	4,091	12	4,079	.893	1.00	47.4	2.
July	2,293	10	2,283	.500	.58	16.7	3.
August	2,118	11	2,107	.461	.53	12.6	4.
September	1,949	2	1,947	.426	.47	51.7	.
The year	7,149	101	7,048	1.542	20.90	50.2	41.
1884–85.							
October	1,832	2	1,830	.400	.46	18.6	2.
November	2,391	5	2,386	.522	.58	18.1	3.
December	4,716	46	4,670	1.022	1.18	25.3	4.
January	5,317	122	5,195	1.137	1.31	26.5	4.
February	4,428	141	4,287	.938	.98	26.7	3.
March	3,543	169	3,374	.738	.85	64.5	1.
April	18,323	194	18,194	3.967	4.43	153.1	2.
May	8,548	150	8,398	1.838	2.12	75.7	2.
June	4,222	32	4,190	.917	1.02	30.1	3.
July	2,850	4	2,846	.623	.72	21.6	3.
August	5,445	2	5,443	1.191	1.37	18.9	7.
September	2,891	2	2,889	.632	.70	45.2	1.
The year	5,376	72	5,304	1.161	15.72	37.9	41.
1885–86.							
October	3,425	2	3,423	.749	.86	21.2	4.
November	9,186	100	9,086	1.988	2.22	39.9	5.
December	6,982	147	6,835	1.496	1.72	52.4	3.
January	13,200	133	13,067	2.859	3.30	58.2	5.
February	17,991	634	17,357	3.798	3.95	73.5	5.
March	12,033	239	11,794	2.581	2.98	94.2	3.
April	22,774	240	22,534	4.931	5.50	269.7	2.
May	6,821	67	6,754	1.478	1.70	54.4	3.
June	3,267	5	3,262	.714	.80	39.0	2.
July	2,275	3	2,272	.497	.57	16.7	3.
August	1,989	2	1,987	.435	.50	14.6	3.
September	1,986	2	1,984	.434	.48	12.6	3.
The year	8,494	131	8,363	1.830	24.58	54.6	45.
1886–87.							
October	2,154	2	2,152	.471	.54	17.8	3.
November	7,032	2	7,030	1.538	1.72	34.8	4.
December	5,969	45	5,924	1.296	1.49	34.8	4.
January	7,822	311	7,511	1.644	1.89	38.5	4.
February	13,217	314	12,903	2.823	2.94	58.0	5.
March	8,424	341	8,083	1.769	2.04	49.2	4.
April	22,189	310	21,879	4.788	5.34	146.7	3.
May	13,814	99	13,715	3,001	3.46	172.1	2.
June	8,193	29	8,164	1.786	1.99	53.4	3.
July	6,674	9	6,665	1.458	1.68	29.4	5.
August	8,566	38	8,528	1.866	2.15	34.3	6.
September	4,197	2	4,195	.918	1.03	67.4	1.
The year	9,021	125	8,896	1.947	26.27	53.3	49.

ack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Mean discharge in second-feet.				Run-off.		Rainfall in inches.
sured at wrence total ainage a, 4,663 uare iles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
3,122	2	3,120	0.682	0.79	35.1	2.24
4,418	2	4,416	.966	1.08	31.7	3.40
6,138	30	6,108	1.337	1.54	37.0	4.16
6,417	73	6,344	1.388	1.60	37.1	4.31
8,480	171	8,309	1.818	1.96	47.9	4.09
10,273	367	9,906	2.168	2.50	44.5	5.62
24,905	330	24,575	5.377	6.00	195.5	3.07
20,921	176	20,745	4.539	5.23	128.6	4.07
5,639	26	5,613	1.228	1.37	52.3	2.62
2,512	7	2,505	.548	.63	34.5	1.83
2,645	7	2,638	.577	.66	14.1	4.71
7,135	97	7,038	1.540	1.72	20.3	8.47
8,550	107	8,443	1.848	25.08	51.6	48.59
12,368	229	12,139	2.656	3.06	52.3	5.85
13,528	329	13,199	2.888	3.22	54.7	5.89
14,920	383	14,537	3.181	3.67	89.0	4.12
12,295	328	11,967	2.619	3.02	61.0	4.95
6,271	124	6,147	1.345	1.40	75.3	1.86
11,037	138	10,899	2.385	2.75	121.1	2.27
11,142	137	11,005	2.408	2.69	91.7	2.93
6,623	56	6,567	1.437	1.66	54.0	3.07
5,390	69	5,321	1.167	1.30	40.8	3.18
3,609	35	3,574	.782	.90	13.8	6.51
5,182	214	4,968	1.087	1.25	44.4	2.82
3,498	72	3,426	.750	.84	20.3	4.12
8,822	176	8,646	1.892	25.76	54.2	47.57
5,711	137	5,574	1.220	1.41	32.6	4.31
8,976	184	8,792	1.924	2.15	37.0	5.80
13,125	276	12,849	2.812	3.24	92.3	3.51
6,955	135	6,820	1.492	1.72	58.1	2.96
7,721	155	7,566	1.656	1.72	46.0	3.75
15,667	469	15,198	3.326	3.83	64.3	5.96
17,244	208	17,036	3.728	4.16	200.9	2.07
14,285	137	14,148	3.096	3.57	65.4	5.46
7,881	38	7,843	1.716	1.91	67.2	2.85
3,161	3	3,158	.691	.80	21.4	3.72
3,406	2	3,404	.745	.86	16.3	5.27
8,397	20	8,377	1.833	2.05	38.3	5.34
9,377	147	9,230	2.020	27.42	53.8	51.00
2,314	211	12,103	2.648	3.05	39.9	7.66
8,871	106	8,765	1.918	2.14	134.6	1.59
6,573	93	6,480	1.418	1.63	38.1	4.29
3,298	395	12,903	2.823	3.25	50.5	6.44
3,499	470	13,029	2.851	2.97	70.5	4.21
3,616	577	23,039	5.041	5.81	113.3	5.13
1,519	292	21,227	4.645	5.18	183.1	2.83
7,347	30	7,317	1.601	1.85	83.5	2.21
4,542	17	4,525	.990	1.11	32.8	3.37
2,895	3	2,892	.633	.73	18.2	4.00
2,460	2	2,458	.538	.62	19.1	3.25
2,544	3	2,541	.556	.62	33.4	1.86
,956	183	9,773	2.139	28.96	61.8	46.84

Monthly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 3
1880–1915—Continued.

Month.	Mean discharge in second-feet.				Run-off.		Rainfal in inche
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
1891-92.							
October	2,137	3	2,134	0.467	0.54	17.4	3.0
November	2,469	3	2,466	.540	.60	25.4	2.3
December	4,113	3	4,110	.899	1.04	26.3	3.9
January	8,524	132	8,392	1.836	2.12	46.2	4.5
February	4,302	76	4,226	.925	1.00	44.1	2.2
March	7,330	192	7,138	1.562	1.80	67.2	2.6
April	8,150	43	8,107	1.774	1.98	271.1	.7
May	10,233	109	10,124	2.215	2.55	45.2	5.6
June	5,819	6	5,813	1.272	1.42	32.9	4.3
July	4,757	2	4,755	1.040	1.20	44.8	2.6
August	4,807	3	4,804	1.051	1.21	18.9	6.4
September	3,944	2	3,942	.863	.96	43.2	2.2
The year	5,549	48	5,501	1.204	16.42	40.1	40.9
1892-93.							
October	2,135	2	2,133	.467	.54	40.8	1.3
November	6,494	6	6,488	1.420	1.58	31.7	5.0
December	3,931	4	3,927	.859	.99	101.1	.9
January	2,949	3	2,946	.645	.74	31.1	2.3
February	4,995	56	4,939	1.081	1.12	18.5	6.0
March	10,723	300	10,423	2.281	2.63	93.6	2.8
April	15,563	213	15,350	3.359	3.75	139.8	2.6
May	19,504	303	19,201	4.202	4.84	87.4	5.5
June	4,404	5	4,399	.963	1.07	40.1	2.6
July	2,389	2	2,387	.522	.60	27.8	2.1
August	2,582	3	2,579	.564	.65	12.7	5.1
September	2,782	3	2,779	.608	.68	33.3	2.0
The year	6,538	75	6,463	1.414	19.19	49.4	38.8
1893-94.							
October	3,614	2	3,612	.790	.91	20.7	4.4
November	3,366	2	3,364	.736	.82	42.3	1.9
December	5,330	2	5,328	1.166	1.34	31.4	4.2
January	3,022	2	3,020	.661	.76	28.2	2.7
February	4,274	8	4,266	.933	.97	33.5	2.9
March	14,375	140	14,235	3.115	3.59	280.6	1.2
April	11,085	111	10,974	2.401	2.68	113.5	2.3
May	6,992	21	6,971	1.525	1.76	42.6	4.1
June	6,033	15	6,018	1.317	1.47	87.5	1.6
July	2,278	2	2,276	.498	.57	20.1	2.8
August	1,695	2	1,693	.370	.43	22.4	1.9
September	1,831	2	1,829	.400	.45	13.6	3.2
The year	5,324	26	5,298	1.159	15.75	46.7	33.7
1894-95.							
October	2.254	2	2,252	.493	.57	15.1	3.7
November	3,549	23	3,526	.772	.86	32.6	2.6
December	3,033	11	3,022	.661	.76	26.6	2.8
January	2,887	27	2,860	.626	.72	24.0	3.0
February	2,319	3	2,316	.507	.53	58.6	.9
March	5,857	108	5,749	1.258	1.45	65.0	2.2
April	19,840	237	19,603	4.289	4.79	96.9	4.9
May	6,233	18	6,215	1.360	1.57	71.6	2.1
June	3,038	3	3,035	.664	.74	25.9	2.8
July	2,583	2	2,581	.565	.65	16.4	3.9
August	2,180	2	2,178	.477	.55	16.0	3.4
September	1,673	2	1,671	.366	.41	15.2	2.6
The year	4,621	36	4,585	1.005	13.60	38.3	35.4

ck River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Mean discharge in second-feet.				Run-off.		
red at rence tal nage 4,663 are es).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	Rainfall in inches.
4,010	66	3,944	0.863	0.99	017.9	5.56
9,558	205	9,353	2.047	2.28	36.8	6.21
9,404	150	9,254	2.025	2.34	67.1	3.48
6,546	61	6,485	1.419	1.64	104.2	1.57
,109	239	8,870	1.941	2.09	39.0	5.37
,054	445	20,609	4.510	5.20	79.6	6.53
,234	105	18,129	3.967	4.43	351.3	1.26
,438	2	4,436	.971	1.12	47.4	2.36
,518	2	3,516	.769	.86	37.6	2.28
,042	2	2,040	.446	.51	16.4	3.13
,019	2	2,017	.441	.51	16.5	3.08
,122	2	3,120	.683	.76	11.7	6.51
,754	107	7,647	1.673	22.73	48.0	47.34
,186	2	5,184	1.134	1.31	34.5	3.80
,662	19	6,643	1.454	1.62	51.0	3.18
,359	7	4,352	.952	1.10	72.2	1.52
,409	4	3,405	.745	.86	24.1	3.56
,571	2	4,569	1.000	1.04	39.4	2.64
,571	86	10,485	2.294	2.64	72.1	3.67
,612	66	17,546	3.839	4.28	177.7	2.41
,117	23	10,094	2.209	2.55	53.8	4.73
,708	54	12,654	2.769	3.09	50.7	6.09
,799	17	10,782	2.359	2.72	39.1	6.95
072	21	5,051	1.105	1.27	37.5	3.40
759	4	2,755	.603	.67	32.7	2.06
819	25	7,794	1.705	23.15	52.6	44.01
207	4	2,203	.482	.56	60.4	.92
827	6	5,821	1.274	1.42	22.5	6.32
376	38	10,338	2.262	2.61	53.0	4.92
394	24	7,370	1.613	1.86	35.2	5.28
797	312	7,485	1.638	1.71	39.8	4.29
612	615	17,997	4.042	4.66	315.0	1.48
228	466	14,762	3.316	3.70	84.3	4.39
996	314	10,682	2.399	2.77	81.9	3.38
464	158	6,306	1.416	1.58	49.1	3.22
660	57	2,603	.585	.67	23.9	2.82
799	346	3,453	.776	.89	13.8	6.48
910	81	2,829	.636	.71	21.4	3.31
356	202	7,654	1.697	23.14	49.4	46.81
29	323	6,106	1.372	1.58	24.9	6.35
87	565	9,322	2.094	2.34	41.4	5.65
79	449	8,330	1.871	2.16	74.9	2.88
57	481	7,376	1.657	1.91	59.1	3.23
82	289	4,593	1.032	1.07	30.6	3.50
48	913	11,035	2.479	2.86	43.9	6.51
38	809	25,629	5.757	6.42	406.6	1.58
28	87	9,441	2.121	2.44	178.5	1.37
80	12	2,968	.667	.74	24.2	3.07
81	8	2,473	.556	.64	15.7	4.09
86	7	2,079	.467	.54	24.5	2.20
94	6	1,988	.447	.50	11.7	4.27
41	329	7,612	1.710	23.20	51.9	44.70

Monthly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. 1880–1915—Continued.

Month.	Mean discharge in second-feet.				Run-off.		Rain in inc
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
1899–1900.							
October	1,789	6	1,783	0.401	0.46	023.2	1
November	2,792	12	2,780	.625	.70	31.4	2
December	2,797	27	2,770	.622	.72	41.2	1
January	3,360	28	3,332	.748	.86	18.4	4
February	16,481	812	15,669	3.520	3.67	45.3	8
March	16,245	926	15,319	3.441	3.97	69.4	5
April	18,500	305	18,195	4.087	4.56	253.4	1
May	10,034	307	9,727	2.185	2.52	73.9	3
June	3,957	50	3,907	.878	.98	38.6	2
July	1,818	7	1,811	.407	.47	18.8	2
August	1,876	7	1,869	.420	.48	15.5	3
September	1,513	7	1,506	.338	.38	11.2	3
The year	6,764	208	6,556	1.473	19.77	48.0	41
1900–1901.							
October	2,517	8	2,509	.564	.65	18.6	3
November	5,849	45	5,804	1.304	1.45	24.6	5
December	6,783	169	6,614	1.486	1.71	66.9	2
January	3,381	31	3,350	.752	.87	49.0	1
February	2,452	20	2,432	.546	.57	68.6	
March	9,510	324	9,186	2.063	2.38	47.3	5
April	26,025	1,238	24,787	5.568	6.21	84.3	7
May	15,612	732	14,880	3.342	3.85	59.3	6
June	7,521	147	7,374	1.656	1.85	116.3	1
July	2,891	23	2,868	.644	.74	14.7	5
August	4,449	46	4,403	.989	1.14	26.5	4
September	2,657	40	2,617	.588	.66	22.8	2
The year	7,471	235	7,236	1.625	22.08	46.7	47
1901–2.							
October	4,128	65	4,063	.913	1.05	32.8	3
November	3,050	139	2,911	.654	.73	35.9	2
December	9,756	611	9,145	2.054	2.37	31.4	7
January	10,454	359	10,095	2.268	2.61	110.3	2
February	5,620	296	5,324	1.196	1.25	34.5	3
March	27,884	1,124	26,760	6.011	6.93	129.8	5
April	17,392	472	16,920	3.801	4.24	94.7	4
May	10,168	127	10,041	2.255	2.60	98.1	2
June	5,292	9	5,283	1.187	1.32	40.9	3
July	4,327	7	4,320	.970	1.12	28.0	4
August	3,763	6	3,757	.844	.97	21.8	4
September	3,452	6	3,446	.774	.86	18.6	4
The year	8,774	268	8,506	1.911	26.05	54.7	47
1902–3.							
October	7,162	40	7,122	1.600	1.84	36.1	5
November	5,748	29	5,719	1.285	1.43	140.5	1
December	8,119	304	7,815	1.755	2.02	35.8	5
January	7,699	202	7,497	1.684	1.94	58.0	3
February	9,309	497	8,812	1.979	2.06	54.3	3
March	27,675	826	26,849	6.031	6.95	119.5	5
April	15,587	562	15,025	3.375	3.77	143.2	2
May	4,365	6	4,359	.979	1.13	137.7	
June	10,295	394	9,901	2.224	2.48	29.9	8
July	4,648	52	4,596	1.032	1.19	33.5	3
August	3,338	71	3,267	.734	.85	24.5	3
September	2,371	13	2,358	.530	.59	31.6	1
The year	8,860	250	8,610	1.934	26.25	57.88	45

ck River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Mean discharge in second-feet.				Run-off.		Rainfall in inches.
sured at wrence total ainage a, 4,663 quare iles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
3,709	30	3,679	0.826	0.95	24.9	3.82
2,998	39	2,959	.665	.74	44.1	1.68
3,720	47	3,673	.825	.95	32.1	2.96
2,642	41	2,601	.584	.67	18.4	3.67
2,944	76	2,868	.644	.69	33.3	2.09
12,318	214	12,104	2.719	3.13	117.0	2.68
20,704	695	20,009	4.494	5.02	68.0	7.38
17,426	318	17,108	3.843	4.43	127.3	3.48
4,667	142	4,525	1.016	1.13	36.9	3.07
2,797	19	2,778	.624	.72	30.6	2.35
2,575	25	2,550	.573	.66	17.5	3.77
2,913	5	2,908	.653	.73	14.1	5.15
6,618	138	6,480	1.456	19.82	47.1	42.10
3,636	5	3,631	.816	.94	55.0	1.71
2,697	8	2,689	.604	.67	49.9	1.35
1,819	5	1,814	.407	.47	22.3	2.11
3,871	66	3,805	.855	.99	21.1	4.67
2,272	32	2,240	.503	.52	34.0	1.54
10,563	104	10,459	2.349	2.71	87.4	3.10
16,185	91	16,094	3.615	4.03	183.4	2.20
5,216	13	5,203	1.169	1.35	92.3	1.46
4,164	21	4,143	.931	1.04	21.3	4.87
2,674	5	2,669	.600	.69	20.1	3.44
2,702	5	2,697	.606	.70	18.1	3.85
7,631	37	7,594	1.706	1.90	27.8	6.84
5,286	33	5,253	1.180	16.01	43.1	37.14
3,261	23	3,238	.727	.84	59.1	1.42
3,388	5	3,383	.760	.85	37.4	2.27
5,687	16	5,671	1.274	1.47	38.3	3.84
7,664	73	7,591	1.705	1.97	75.9	2.59
5,108	65	5,043	1.133	1.18	49.6	2.38
7,684	217	7,467	1.677	1.93	42.8	4.52
16,159	174	15,985	3.591	4.01	158.4	2.53
10,140	40	10,100	2.269	2.62	44.6	5.87
10,114	44	10,070	2.262	2.52	50.5	5.00
4,951	27	4,924	1.106	1.27	27.8	4.59
3,314	17	3,297	.741	.85	30.9	2.76
1,885	8	1,877	.422	.47	27.8	1.69
6,613	59	6,554	1.472	19.98	50.6	39.46
2,451	8	2,443	.549	.63	18.9	3.35
3,167	21	3,146	.707	.79	31.5	2.50
2,558	36	2,522	.566	.65	17.2	3.80
6,400	117	6,283	1.411	1.63	67.0	2.43
3,054	85	2,969	.667	.69	38.4	1.81
7,799	106	7,693	1.728	1.99	101.7	1.96
13,141	129	13,012	2.923	3.26	111.7	2.92
9,124	70	9,054	2.034	2.35	84.7	2.77
5,351	55	5,296	1.190	1.33	40.0	3.32
3,341	8	3,333	.749	.86	25.1	3.44
1,927	7	1,920	.431	.50	35.0	1.42
2,965	8	2,957	.664	.74	8.7	8.48
5,106	54	5,052	1.135	15.42	40.4	38.20

Monthly discharge of Merrimack River at Lawrence, Mass., for the years ending Sept. *1880–1915*—Continued.

Month.	Mean discharge in second-feet.				Run-off.		Rain in inc
	Measured at Lawrence (total drainage area, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
1907–8.							
October	6,388	8	6,380	1.433	1.65	36.2	
November	13,066	94	12,972	2.914	3.25	64.5	
December	9,812	120	9,692	2.177	2.51	66.9	
January	8,824	159	8,665	1.946	2.244	77.9	
February	7,487	152	7,335	1.648	1.777	41.7	
March	11,400	275	11,125	2.499	2.881	109.1	
April	11,967	159	11.808	2.652	2.959	140.9	
May	11,575	135	11,440	2.570	2.963	61.7	
June	4,193	45	4,148	.932	1.040	100.9	
July	2,329	7	2,322	.522	.601	15.6	
August	2.986	14	2,972	.668	.770	15.2	
September	1,693	7	1;686	.379	.423	46.4	
The year	7,643	98	7,545	1.695	23.068	56.4	
1908–9.							
October	1,474	7	1,467	.330	.380	17.0	
November	1,590	15	1,575	.354	.395	37.6	
December	1,886	16	1,870	.420	.484	16.6	
January	3,025	11	3,014	.677	.781	20.2	
February	7,118	161	6,957	1.563	1.627	31.8	
March	7,718	173	7,545	1.695	1.954	55.5	
April	15,315	159	15,156	3.404	3.798	88.5	
May	8,790	103	8,687	1.951	2.250	91.1	
June	4,247	26	4,221	.948	1.058	38.1	
July	1,999	7	1,992	.447	.516	20.3	
August	1,682	7	1,675	.376	.434	15.1	
September	1,652	7	1,645	.369	.412	9.4	
The year	4,708	58	4,650	1.044	14.089	37.0	
1909–10.							
October	1,886	8	1,878	.422	.486	38.3	
November	1,745	19	1,726	.388	.433	17.4	
December	2,265	23	2,242	.504	.581	17.1	
January	4,759	117	4,642	1.043	1.202	26.5	
February	4,493	161	4,332	.973	1.013	22.7	
March	16,311	236	16,075	3.611	4.163	358.9	
April	10,986	101	10,885	2.445	2.728	93.1	
May	6,751	32	6,719	1.509	1.740	86.1	
June	4,876	81	4,795	1.077	1.202	30.9	
July	1,786	13	1,773	.398	.459	23.5	
August	2,042	5	2,037	.458	.528	17.1	
September	1,771	5	1,766	.397	.443	14.7	
The year	4,973	67	4,906	1.102	14.978	43.8	
1910–11.							
October	1,341	6	1,335	.300	.346	23.4	
November	2,053	18	2,035	.457	.510	15.4	
December	1,511	21	1,490	.335	.386	16.6	
January	2,814	36	2,778	.624	.719	29.7	
February	2,164	17	2,147	.482	.502	19.5	
March	5,584	30	5.554	1.248	1.438	40.9	
April	13,591	34	13,557	3.045	3.397	182.7	
May	6,064	9	6,055	1.360	1.568	127.5	
June	2,462	7	2,455	.551	.615	23.5	
July	1,190	6	1,184	.266	.307	8.2	
August	1,467	6	1,461	.328	.378	8.2	
September	1,942	5	1,937	.435	.485	15.0	
The year	3,515	16	3,499	.786	10.651	32.3	

ack River at Lawrence, Mass., for the years ending Sept. 30, 1880–1915—Continued.

Mean discharge in second-feet.				Run-off.		Rainfall in inches.
asured at awrence (total rainage ea, 4,663 square miles).	Wasting into Merrimack River from diverted drainage basins.	From net drainage area.	Per square mile of net drainage area.	Depth in inches on drainage area.	Per cent of rainfall.	
4,095	6	4,089	0.918	1.059	25.8	4.11
4,687	19	4,668	1.049	1.170	32.1	3.65
5,752	34	5,718	1.284	1.481	47.6	3.11
3,594	22	3,572	.802	.925	34.3	2.70
3,196	51	3,145	.706	.762	34.3	2.22
12,601	255	12,346	2.773	3.197	60.1	5.32
19,454	208	19,246	4.323	4.823	135.5	3.56
10,461	236	10,225	2.297	2.648	52.4	5.05
5,832	26	5,806	1.304	1.455	220.5	.66
1.838	5	1.833	.412	.475	13.8	3.45
2,230	7	2,223	.499	.576	16.9	3.40
2,162	5	2,157	.485	.541	19.1	2.83
6,325	73	6,252	1.404	19.112	47.7	40.06
3,268	6	3,262	.733	.845	31.2	2.71
5,533	15	5,518	1.239	1.383	39.6	3.49
4,790	32	4,758	1.069	1.232	29.3	4.20
8,007	106	7,901	1.775	2.046	73.3	2.79
4,465	70	4,395	.987	1.028	40.3	2.55
15,204	190	15,014	3.372	3.888	73.2	5.31
11,309	223	11,086	2.490	2.778	86.8	3.20
6,496	76	6,420	1.442	1.663	43.2	3.85
4,032	28	4,004	.899	1.003	90.4	1.11
1,757	8	1,749	.393	.453	18.6	2.44
1,372	10	1,362	.306	.353	11.5	3.07
1,735	11	1,724	.387	.432	12.9	3.36
5,664	65	5,599	1.258	17.104	45.0	38.08
3,552	30	3,522	.791	.912	15.7	5.81
4,352	45	4,307	.967	1.079	46.5	2.32
4,735	79	4,656	1.046	1.206	42.0	2.87
3,381	115	3,266	.734	.846	28.4	2.98
4,424	157	4,267	.958	.998	35.6	2.80
14,722	275	14,447	3.245	3.741	84.4	4.43
22,356	300	22,056	4.954	5.527	105.3	5.25
12,996	175	12,821	2.880	3.320	143.7	2.31
3,292	11	3,281	.737	.822	39.1	2.10
2,505	17	2,488	.559	.644	18.7	3.45
1,946	16	1,930	.434	.500	12.1	4.12
1,991	8	1,983	.445	.496	127.2	.39
6,688	102	6,586	1.479	20.091	51.7	38.83
1,358	8	1,350	.303	.349	23.7	1.47
1,614	28	1,586	.356	.397	15.3	2.60
1,976	31	1,945	.437	.504	16.9	2.99
4,972	162	4,810	1.080	1.245	25.1	4.96
7,974	218	7,756	1.742	1.814	51.0	3.56
6,678	65	6,613	1.485	1.712	2,140.0	.08
7,987	26	7,961	1.788	1.995	89.5	2.23
5,039	25	5,014	1.126	1.298	81.6	1.59
2.189	10	2.179	.489	.546	22.7	2.41
8,158	98	8,060	1.810	2.087	21.6	9.62
9,303	113	9,190	2.064	2.379	38.9	6.12
2,936	18	2,918	.655	.731	55.4	1.32
5,015	67	4.948	1.110	15.057	38.7	38.95

wasted from diverted drainage area based on data furnished by the Metro-
rd of Boston.

Days of deficiency in discharge of Merrimack River at Lawrence, Mass., during the years ending Sept. 30, 1880–1915.

Discharge in second-feet.	Theoretical horse-power per foot of fall.	Days of deficiency in discharge.											
		1879–80	1880–81	1881–82	1882–83	1883–84	1884–85	1885–86	1886–87	1887–88	1888–89	1889–90	1890–91
50	5.7	......	......	......	5	1	......	......	......	......	......	......	......
100	11.4	2	4	......	5	2	......	......	1	......	......	......	......
200	22.7	2	4	......	7	4	3	2	1	1	......	......	......
400	45.5	4	6	1	9	9	6	6	2	3	1	......	......
600	68.2	6	7	4	16	15	9	10	3	8	1	1	1
800	90.9	6	9	9	23	20	10	13	3	11	1	5	5
1,000	114	8	15	11	27	21	11	14	3	13	1	7	8
1,500	170	16	24	13	42	27	14	19	5	15	5	7	8
2,000	227	19	43	19	72	43	40	27	9	26	9	12	11
2,500	284	46	88	63	137	124	93	79	30	32	14	31	42
3,000	341	123	154	90	198	165	125	111	37	80	40	41	64
3,500	398	151	198	106	234	187	161	132	55	121	55	54	85
4,000	455	173	214	119	257	203	203	143	76	155	69	63	105
4,500	511	191	225	139	274	228	233	156	108	189	88	81	111
5,000	568	206	235	160	287	237	248	165	144	204	107	95	133
5,500	625	224	245	176	293	241	271	177	158	217	118	113	148
6,000	682	238	249	188	297	247	282	194	174	230	132	129	156
6,500	738	251	256	207	306	253	288	209	184	239	142	142	171
7,000	795	259	263	213	313	258	297	220	192	245	154	157	182
7,500	852	274	265	228	320	265	304	235	207	249	163	166	198
8,000	909	285	270	241	323	268	311	242	216	254	170	173	210
8,500	966	298	275	254	330	272	317	248	227	256	181	194	216
9,000	1,020	305	278	262	334	274	319	259	238	261	191	207	220
10,000	1,140	318	289	279	336	279	323	269	251	266	222	226	234
12,000	1,360	329	304	302	342	302	330	289	283	280	290	258	255
16,000	1,820	344	318	335	351	321	338	313	317	298	336	315	297
20,000	2,270	358	345	352	355	330	353	325	328	309	351	335	312
25,000	2,840	363	358	360	360	345	365	346	347	345	361	364	336
30,000	3,410	366	365	363	363	355	......	354	356	356	363	365	353
40,000	4,550	......	......	365	365	362	......	363	364	366	365	......	364
50,000	5,680	......	......	......	......	366	......	365	365	......	......	......	365
70,000	6,820	......	......	......	......	......	......	......	......	......	......	......	......
90,000	7,950	......	......	......	......	......	......	......	......	......	......	......	......

e of Merrimack River at Lawrence, Mass., during the years g Sept. 30, 1880–1915—Continued.

Days of deficiency in discharge.								
1893–94	1894–95	1895–96	1896–97	1897–98	1898–99	1899–1900	1900–1901	1901–2
....	....	....	....	....	....	2	....	....
....	2	....	....	....	2	6	....	....
4	3	1	....	1	2	11	....	....
10	8	5	....	4	6	19	3	....
12	13	7	....	5	10	24	4	1
13	15	10	....	5	12	26	8	2
14	19	10	....	5	12	30	11	2
32	29	18	3	8	14	44	14	7
60	70	37	12	21	30	78	29	12
102	121	77	25	39	70	154	66	27
153	191	111	57	77	101	192	121	62
187	238	133	83	97	116	206	161	88
208	261	152	105	114	137	224	182	118
225	282	168	127	123	149	231	211	145
239	290	187	154	137	158	234	226	173
249	296	200	176	161	169	239	233	197
257	303	214	188	176	185	244	242	213
269	310	223	203	191	203	249	247	225
274	317	235	215	207	225	252	253	236
280	319	244	223	223	234	257	257	244
286	325	252	235	235	240	263	264	254
294	331	256	245	247	247	265	265	257
299	335	260	250	257	257	268	268	260
314	342	271	273	277	275	274	279	267
334	347	291	302	306	300	296	289	283
348	351	325	331	331	327	325	321	311
358	355	338	348	344	339	341	338	326
363	357	352	359	349	350	352	348	342
365	359	362	361	358	353	357	356	351
....	362	363	363	365	365	362	362	360
....	363	364	365	....	....	364	363	362
....	365	365	....	....	....	365	365	365
....	....	366	....	....	....	....	....	....

Days of deficiency in discharge of Merrimack River at Lawrence, Mass., during the ye ending Sept. 30, 1880–1915—Continued.

Discharge in second-feet.	Theoretical horsepower per foot of fall.	Days of deficiency in discharge. 1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14
50	5.7	......	......	......	......	......	......	......	......	......	......	......	......
100	11.4	......	......	......	1	......	3	4	1	5	......	1	......
200	22.7	......	......	3	4	5	5	19	13	23	5	10	7
400	45.5	3	8	8	4	10	9	29	24	28	15	17	9
600	68.2	4	10	17	4	17	12	31	25	35	18	20	14
800	90.9	5	11	17	5	20	12	33	26	40	19	22	17
1,000	114	5	13	18	6	22	14	34	26	50	20	23	17
1,500	170	5	21	28	12	33	20	61	47	97	29	41	29
2,000	227	13	47	51	21	53	39	111	93	165	43	81	48
2,500	284	29	78	89	49	83	54	187	166	219	84	111	93
3,000	341	56	141	164	73	134	90	208	199	255	134	137	129
3,500	398	80	191	197	104	196	103	216	211	285	165	154	160
4,000	455	102	215	226	139	217	121	231	222	292	188	171	194
4,500	511	126	238	248	165	235	131	244	234	297	209	188	218
5,000	568	141	243	262	189	254	140	252	249	307	235	206	234
5,500	625	168	256	272	207	264	155	266	269	312	250	223	252
6,000	682	180	266	284	221	269	170	276	279	315	257	240	260
6,500	738	196	273	297	238	275	184	287	284	319	261	258	267
7,000	795	209	277	308	247	281	200	291	286	322	267	271	270
7,500	852	225	279	315	260	285	211	296	293	323	272	283	279
8,000	909	238	284	318	270	290	223	301	297	326	275	288	281
8,500	966	249	287	321	280	295	232	302	301	326	280	297	287
9,000	1,020	256	290	325	289	300	241	308	302	328	282	302	293
10,000	1,140	272	295	330	305	311	262	315	306	329	291	320	298
12,000	1,360	290	304	338	320	330	292	334	330	335	313	332	305
16,000	1,820	309	326	343	344	358	335	350	344	356	332	347	312
20,000	2,270	326	341	352	356	362	354	360	355	364	344	354	337
25,000	2,840	344	353	355	359	364	364	362	362	365	356	359	350
30,000	3,410	353	357	358	362	365	365	363	365	......	365	362	361
40,000	4,550	363	364	361	365	......	366	365	......	......	366	365	365
50,000	5,680	365	366	365	......	......	......	......	......	......	......	......	......
70,000	6,820	......	......	......	......	......	......	......	......	......	......	......	......
90,000	7,950	......	......	......	......	......	......	......	......	......	......	......	......

Note.—The above table gives the theoretical horsepower per foot fall that may be developed at differ rates of discharge, and shows the number of days on which the discharge and corresponding horsepo were respectively less than the amounts given in the columns for discharge and horsepower. In us this table, allowance should be made for the various losses, the principal ones being the wheel loss, wh may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

HUA RIVER (WACHUSETT DRAINAGE EAR CLINTON, MASS.

ar Clinton.

e basin has been artificially changed at times in he water-supply systems of the Metropolitan dis-) square miles; 1908 to 1913, 118.19 square miles; les.

to September, 1915.

South Branch of Nashua River has been utilized ient for the Metropolitan district of Boston.

e in Wachusett Reservoir (Pl. XI) and several ponds. ipply have been made by the Metropolitan Water inning with 1897 estimates of discharge have been he reservoir and ponds, so that the record shows w of the stream.

the yield of the drainage area, including the water to 1902, inclusive, the water surface formed 2.2 per .4 per cent; 1904, 3.6 per cent; 1905, 4.1 per cent; cent; 1908–1915, 7 per cent.

for the calendar years furnished by the Metropoli- changed to climatic year by engineers of the Geo-

mile of South Branch of Nashua River[1] *(Wachusett Mass., for the years ending Sept. 30, 1896–1915.*

Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Mean.
......	......	......	......	......	0.519	0.467	0.707	......
1.440	4.270	2.525	1.800	1.828	2.231	1.386	.588	1.787
2.530	4.778	3.137	2.151	1.281	.514	2.049	1.045	2.149
1.687	4.295	5.224	1.334	.869	.548	.365	.387	2.238
6.271	5.759	2.444	2.139	.894	.336	.304	.197	1.735
.551	4.205	7.711	4.222	1.525	.738	.792	.495	2.111
2.168	6.176	3.341	1.595	.635	.452	.459	.372	2.056
3.300	5.297	3.463	.880	3.297	.966	.734	.580	2.140
1.434	4.653	4.617	2.317	1.179	.769	.549	.764	1.735
.700	4.648	2.502	.688	.838	.565	.497	1.900	1.341
1.588	2.878	3.263	2.371	1.831	1.127	.915	.428	1.582
1.070	2.626	2.221	1.494	1.196	.518	.135	1.254	1.332
2.685	3.391	1.964	2.188	.624	.341	.685	.136	1.989
3.955	3.294	3.748	1.876	.977	.361	.299	.321	1.379
2.854	4.084	1.600	.941	1.274	.096	.288	.224	1.304
.967	2.072	2.155	.713	.543	.087	.291	.281	.795
1.434	4.380	3.530	2.780	.512	.208	.194	.138	1.564
1.342	3.501	3.224	1.607	.433	.030	.092	.338	1.241
1.827	4.853	4.012	2.629	.491	.510	.404	−.018	1.652
3.034	.885	1.443	.704	.353	1.676	2.564	.244	1.260

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tatement in station description.

n corrected for loss and gain by storage in ponds and reservoirs.

Summary of yield and rainfall in South Branch of Nashua River (Wachusett drainag basin) for the years ending Sept. 30, 1897–1915.

[Drainage area, 108.84[1] square miles.]

Month.	Yield.					Average rainfall in inches.
	Total in million gallons.	Per square mile.		Average depth in inches on drainage area.	Per cent of rainfall.	
		Million gallons per day.	Second-feet.			
1897–1915.						
October	33,668.5	0.525	0.812	0.936	26.9	3.48
November	48,056.5	.775	1.199	1.338	39.5	3.38
December	74,064.9	1.155	1.787	2.060	50.4	4.08
January	79,014.2	1.233	1.907	2.198	58.2	3.77
February	80,831.7	1.388	2.148	2.249	60.8	3.70
March	165,840.7	2.587	4.002	4.614	111.1	4.15
April	131,084.5	2.113	3.268	3.648	95.5	3.82
May	75,080.0	1.171	1.812	2.089	62.2	3.30
June	43,426.4	.700	1.083	1.208	34.2	3.53
July	26,323.5	.411	.635	.732	17.6	4.16
August	28,114.8	.439	.678	.782	18.1	4.31
September	20,367.1	.328	.508	.567	16.2	3.49
The year	805,872.8	1.068	1.652	22.421	49.5	45.28

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[1] Used as basis of computations in table. See "Drainage area" in station description. Figures in summary represent average quantities.

CONCORD RIVER AT LOWELL, MASS.

LOCATION.—At Lawrence Street Bridge in the city of Lowell.

DRAINAGE AREA:

	Square miles.
Total of Concord River above Lowell	376.
Net drainage area, excluding diversions	[1] 301.

RECORDS AVAILABLE.—January 1, 1901, to September 30, 1915.

GAGES.—Staff gages on east bank above dam and on west bank above head gates.

DISCHARGE MEASUREMENTS.—Mill use determined from water-wheel ratings checked by current-meter measurements. Water wasting over dam computed from weir formula with some corrections for depth.

CHANNEL AND CONTROL.—Control formed by crest of dam and head gates to canal. Channel of river about 100 feet wide from Lawrence Street bridge to North Billerica, 4 miles. Pondage drawn on but little.

EXTREMES OF DISCHARGE.—Maximum flow, 1901–1915, occurred March 3, 1902; approximate discharge, 4,148 second-feet. Minimum flow occurred August 27–31, 1907; discharge, 11 second-feet, through water wheels.

WINTER FLOW.—Not affected by ice.

DIVERSIONS.—75.2 square miles above dam No. 1 of Boston Water Works, and including Farm Pond, diverted from the upper part of Sudbury River for municipal supply for city of Boston. Only waste water from this area reaches the Concord River.

REGULATION.—Distribution of flow somewhat affected by operation of mills between North Billerica and Lowell.

ACCURACY.—Records considered fair.

COOPERATION.—Records furnished by Arthur T. Safford, hydraulic engineer, for the owners of the water power taken from Wamesit Canal.

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[1] Occasional waste water reaches the river from diverted area above dam No. 1.

Concord River at Lowell, Mass., for the years ending
ept. 30, 1901–1915.

an.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
355	278	193	1,235	1,902	2,030	241	390	a 361
359	279	227	1,182	1,703	a1,884	272	379	a 343
349	a 258	a 242	1,192	1,738	1,738	276	386	326
339	237	256	1,296	1,608	1,625	a 252	a 370	299
365	173	298	1,516	a1,562	1,483	227	355	278
319	173	391	1,751	1,516	1,329	253	320	278
273	115	407	a2,080	1,350	1,225	a 237	306	278
293	115	378	2,408	1,260	1,120	222	325	a 252
287	115	392	2,914	1,159	a 973	230	324	225
289	a 144	a 533	3,062	1,094	825	230	363	242
280	173	675	2,892	1,126	771	260	a 337	222
294	130	1,130	2,703	a1,132	686	262	311	208
a 278	130	1,520	2,613	1,138	661	277	310	207
262	145	1,709	a2,313	1,141	623	a 241	277	230
287	159	1,647	2,012	1,131	556	206	292	a 229
287	231	1,623	1,774	1,047	a 508	194	277	228
294	a 231	a1,354	1,643	989	459	249	308	230
306	231	1,085	1,559	936	437	259	a 263	228
294	224	976	1,395	a1,028	391	253	218	241
a 287	239	865	1,367	1,120	358	277	229	254
279	239	843	a1,339	1,427	360	a 260	232	278
295	244	901	1,310	1,635	825	243	204	a 262
260	256	856	1,219	1,703	a 324	242	204	247
291	a 237	a 892	1,292	1,644	322	242	233	236
291	217	927	1,495	1,564	334	253	a 260	228
301	199	1,045	1,960	a1,619	337	248	286	235
a 285	201	1,224	2,258	1,674	306	275	318	235
269	194	1,414	a2,264	1,780	300	a 282	370	265
260	....	1,426	2,271	1,893	282	288	370	a 256
259	....	1,371	2,019	2,050	a 262	319	343	247
272	....	a1,303	....	2,084	....	371	378	....
1,868	826	1,946	1,205	588	a 347	188	175	a 117
1,840	a 831	a3,047	1,185	609	332	182	189	120
1,859	836	4,148	1,147	654	305	182	a 185	110
1,735	841	3,908	941	a 661	305	a 179	180	99
a1,578	782	3,316	765	669	301	a 175	159	127
1,420	810	2,885	a 703	588	303	a 172	136	126
1,226	746	2,929	641	644	303	169	184	a 138
1,053	725	2,704	625	670	a 286	138	187	151
932	a 602	a2,463	1,186	639	269	138	183	151
741	479	2,222	1,436	584	259	138	a 200	164
766	459	2,048	1,636	a 552	275	138	217	164
a 688	418	2,179	1,656	519	231	139	249	164
610	393	2,206	a1,645	441	206	a 139	241	196
523	380	2,205	1,634	406	213	139	268	a 180
532	364	2,165	1,507	375	a 212	125	306	164
545	a 288	a2,165	1,412	365	212	114	316	176
567	212	2,165	1,283	363	189	74	a 280	188
612	241	2,217	1,161	a 319	195	74	243	181
a 544	280	2,004	a1,043	274	200	74	201	181
475	280	1,926	a 924	270	200	a 100	217	208
486	283	1,836	806	282	221	126	206	a 216
661	283	1,687	745	312	a 211	176	192	224
826	a 293	a1,634	696	312	201	189	206	252
922	304	1,581	574	288	194	206	a 197	245
910	308	1,502	590	a 293	188	243	187	231
a 969	396	1,415	635	297	195	242	163	225
1,028	640	1,260	a 597	403	195	a 228	175	224
983	950	1,170	559	380	201	215	175	a 238
868	....	1,219	534	398	a 198	180	125	252
851	....	a1,211	584	377	195	189	110	252
870	....	1,203	....	a 362	....	189	a 113	....

a Discharge interpolated.

Daily discharge, in second-feet, of Concord River at Lowell, Mass., for the years endin Sept. 30, 1901–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1902–3.												
1	293	791	319	1,050	[a] 780	[a]1,117	1,622	529	235	1,460	288	20
2	315	[a] 640	307	992	778	1,451	1,627	524	226	1,321	[a] 276	21
3	322	490	298	958	880	1,668	1,718	[a] 450	218	1,162	265	21
4	334	472	337	[a]1,061	915	1,694	1,654	395	222	[a]1,054	256	21
5	[a] 333	400	386	1,159	1,080	1,650	[a]1,533	404	221	[a] 966	271	21
6	331	401	414	1,071	1,139	1,615	1,418	376	219	855	271	[a] 21
7	307	361	[a] 412	1,009	1,159	1,431	1,345	376	[a] 219	826	298	[a] 21
8	304	382	410	974	[a]1,331	[a]1,330	1,307	371	219	683	334	21
9	340	[a] 351	393	903	1,114	1,254	1,397	382	218	603	[a] 327	21
10	340	320	360	899	1,119	1,343	1,428	[a] 382	209	545	320	21
11	350	324	357	[a] 904	1,178	1,488	1,475	370	219	523	327	21
12	[a] 348	302	337	904	1,221	1,693	[a]1,506	360	250	[a] 473	303	21
13	346	298	399	852	1,277	1,707	1,536	363	330	416	298	[a] 21
14	365	312	[a] 326	746	1,247	1,683	1,470	349	[a] 368	395	304	18
15	352	343	253	651	[a]1,195	[a]1,576	1,410	332	414	388	288	16
16	311	[a] 325	318	575	1,123	1,457	1,333	345	618	369	[a] 301	16
17	330	307	402	536	980	1,335	1,273	[a] 323	693	354	314	16
18	361	306	447	[a] 516	862	1,225	1,252	296	768	316	252	16
19	[a] 337	306	510	486	777	1,196	[a]1,247	305	793	[a] 333	255	16
20	312	302	608	484	870	1,129	[a]1,243	305	803	335	265	[a] 16
21	265	303	[a] 894	624	888	1,116	1,227	292	[a]1,045	345	239	14
22	263	330	1,180	704	[a] 919	[a]1,116	1,112	274	1,298	351	239	13
23	365	[a] 312	1,204	678	908	1,121	1,050	283	1,514	360	[a] 217	13
24	281	294	1,194	719	765	1,200	953	[a] 285	2,326	368	195	13
25	280	276	[a]1,189	[a] 666	682	1,235	1,001	262	2,521	387	162	13
26	[a] 272	302	1,184	618	703	1,724	[a] 875	237	2,508	[a] 368	141	13
27	264	[a] 315	1,162	580	702	1,837	732	237	2,347	340	163	[a] 13
28	342	328	[a]1,160	611	783	1,793	700	237	[a]2,072	333	164	14
29	381	355	1,157	583	....	[a]1,723	635	271	1,758	297	188	14
30	444	[a] 337	1,187	690	....	1,638	604	[a] 259	1,552	328	[a] 192	14
31	530	....	1,099	794	....	1,581	....	[a] 247	....	321	195	......
1903–4.												
1	135	[a] 314	234	309	239	447	1,151	[a]2,410	353	340	191	16
2	136	303	253	298	238	443	1,186	2,861	352	339	190	16
3	99	273	267	[a] 267	239	420	[a]1,190	2,646	373	[a] 338	196	16
4	[a] 118	273	239	237	238	472	1,195	2,463	342	[a] 337	191	[a] 15
5	136	273	244	237	238	502	1,155	2,174	[a] 354	336	191	[a] 15
6	136	273	[a] 247	237	226	[a] 475	1,068	1,930	365	341	[a] 191	14
7	129	284	251	237	[a] 232	447	993	1,700	384	342	[a] 197	10
8	158	[a] 278	260	237	238	668	982	[a]1,480	403	325	204	8
9	159	273	235	237	238	827	958	1,259	389	284	231	3
10	161	272	326	[a] 212	207	1,098	[a]1,080	1,151	379	[a] 287	252	2
11	[a] 187	260	334	187	203	1,322	1,203	1,067	396	291	252	[a] 3
12	212	238	[a] 329	187	208	1,362	1,360	1,050	[a] 374	263	248	4
13	245	244	[a] 323	187	213	[a]1,319	1,405	986	352	264	212	6
14	299	249	318	214	[a] 213	1,277	1,338	932	346	239	[a] 212	6
15	312	[a] 252	333	243	213	1,171	1,285	[a] 841	351	248	212	32
16	311	239	372	240	212	1,111	1,172	750	338	205	239	43
17	275	224	354	[a] 241	212	987	[a]1,107	711	269	[a] 209	243	45
18	[a] 347	330	333	241	212	879	1,042	651	232	213	224	[a] 46
19	417	370	331	239	212	665	[a] 971	610	[a] 254	162	210	47
20	459	386	[a] 343	239	196	[a] 768	900	620	276	110	230	45
21	450	394	355	215	[a] 217	872	766	628	256	106	[a] 248	39
22	404	[a] 379	433	237	239	989	713	[a] 634	247	110	266	35
23	406	358	418	239	263	1,117	692	640	247	110	263	33
24	383	357	433	[a] 239	341	1,136	[a] 639	580	214	[a] 111	275	31
25	[a] 375	360	[a] 409	239	467	1,271	585	474	198	113	275	[a] 30
26	357	[a] 337	[a] 384	231	414	1,441	511	493	[a] 223	110	267	30
27	344	316	[a] 360	237	379	[a]1,465	478	465	249	135	279	25
28	336	316	336	239	[a] 423	1,490	698	366	249	163	[a] 271	23
29	328	[a] 310	329	239	468	1,439	1,344	[a] 362	250	187	263	23
30	350	298	325	226	....	1,338	1,959	[a] 358	249	187	234	25
31	325	....	317	[a] 233	....	1,233	....	354	....	[a] 189	185	......

[a] Discharge interpolated.

ncord River at Lowell, Mass., for the years ending 1901–1915—Continued.

.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
0	282	184	1,792	349	164	199	206	58
0	287	178	a1,606	344	163	a 216	200	58
8	281	184	1,420	334	163	a 234	202	a 360
5	265	184	1,316	333	a 163	a 251	205	a 662
0	a 252	a 184	1,151	322	163	268	186	964
8	239	184	1,139	310	162	187	a 170	1,198
0	240	184	1,141	a 305	128	188	154	1,266
5	240	184	1,152	301	111	188	140	1,259
9	240	214	a1,101	291	129	a 187	122	1,164
2	240	333	1,050	285	125	186	131	a 1,007
2	241	407	930	269	a 156	146	154	850
2	a 242	a 532	925	269	187	128	129	781
0	242	656	837	271	252	93	a 135	745
9	241	669	823	a 275	307	92	141	594
76	241	668	797	278	322	93	106	538
4	240	647	a 741	287	338	a 140	117	503
78	240	637	685	294	334	186	155	a 463
9	224	598	663	305	a 307	186	155	423
3	a 230	a 894	596	322	279	186	153	381
29	237	1,190	528	343	275	186	a 170	279
10	238	1,388	485	a 335	266	186	188	361
77	210	1,281	a 472	327	316	185	188	353
43	214	1,296	a 460	318	375	a 185	187	350
02	208	1,329	447	318	406	186	128	a 329
71	209	1,370	414	318	a 429	127	129	308
87	a 202	a1,504	385	313	452	109	129	320
83	196	1,638	383	316	422	92	a 129	301
03	184	1,920	367	a 309	392	92	129	282
02	....	2,027	358	301	399	92	127	276
01	....	1,942	a 353	216	346	a 133	82	277
01	....	1,880	....	165	....	174	57	....
93	478	1,198	a1,706	561	1,285	a 385	350	227
38	442	791	1,746	533	1,273	435	370	a 209
17	412	718	1,702	506	a1,203	448	399	a 190
30	a 396	a 949	1,597	513	1,133	a 481	433	172
81	379	1,179	1,474	473	996	513	a 450	176
28	302	1,460	1,348	a 463	925	483	408	178
40	338	1,513	1,253	453	810	478	450	177
53	321	1,500	a1,227	456	695	a 460	445	178
565	312	1,381	1,201	475	650	443	425	a 183
527	310	1,418	1,241	463	a 615	425	405	187
472	a 306	a1,388	1,347	458	580	375	423	156
432	303	1,358	1,482	455	519	357	a 402	138
422	316	1,113	1,554	a 440	501	354	381	62
412	310	1,087	1,671	426	454	351	326	63
402	291	1,024	a1,605	391	421	a 342	310	63
427	297	853	1,538	380	383	333	297	a 99
510	308	790	1,457	355	a 421	307	290	135
550	a 309	a 780	1,373	352	459	303	271	82
565	309	770	1,307	351	491	293	a 262	83
553	311	718	1,241	a 337	586	288	253	76
551	320	718	1,178	323	620	a 296	208	98
550	545	698	a1,064	294	596	a 305	200	27
560	780	648	949	296	554	313	225	a 93
595	932	580	882	281	a 522	312	219	158
627	a 975	a 554	859	262	491	313	256	158
652	1,017	529	782	294	448	312	a 250	157
662	1,023	579	747	a 345	408	312	244	157
626	921	818	689	396	360	311	251	157
590	....	1,129	a 679	669	351	a 314	262	157
535	....	1,436	669	a 933	335	316	265	a 158
490	....	1,666	....	1,196	....	315	199	....

Discharge interpolated.

Daily discharge, in second-feet, of Concord River at Lowell, Mass., for the years endi Sept. 30, 1901–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep
1906–7.												
1	158	284	300	611	339	303	889	473	342	166	124	[a]
2	152	271	[a] 307	838	340	293	753	453	[a] 349	166	125	[a]
3	152	281	314	990	[a] 347	[a] 304	690	438	356	166	108	
4	151	[a] 286	259	1,143	354	315	677	415	411	[a] 198	[a] 114	
5	150	291	240	1,481	347	318	651	[a] 409	456	229	119	
6	150	238	239	[a]1,294	374	317	621	403	523	260	119	
7	[a] 154	243	240	1,106	383	331	[a] 576	434	530	[a] 213	119	
8	158	243	239	1,065	382	328	531	421	516	166	119	[a]
9	164	242	[a] 241	1,049	362	324	542	419	[a] 503	165	119	
10	296	293	243	960	[a] 375	[a] 310	602	410	491	165	118	
11	120	[a] 300	243	914	387	297	640	397	479	164	[a] 106	
12	120	308	243	910	358	328	693	[a] 424	438	164	94	
13	120	339	249	[a] 790	342	322	745	450	411	165	100	
14	[a] 142	360	241	670	352	318	[a] 826	439	366	[a] 177	82	
15	163	347	242	637	377	342	906	425	350	188	82	[a]
16	163	372	[a] 264	514	378	549	901	415	[a] 345	216	72	
17	84	400	286	430	[a] 369	[a] 787	879	395	339	216	72	
18	84	[a] 428	268	435	360	1,025	851	404	313	219	[a] 62	
19	84	455	282	459	372	1,220	[a] 802	[a] 413	277	168	53	
20	68	465	286	[a] 468	354	1,358	[a] 754	421	276	169	53	
21	[a] 106	465	312	476	356	1,350	[a] 705	397	278	[a] 169	53	
22	144	440	322	541	336	1,318	657	393	303	168	69	[a]
23	197	420	[a] 310	533	327	1,238	581	385	[a] 299	168	75	
24	197	433	298	453	[a] 325	[a]1,210	548	365	295	166	64	
25	189	[a] 394	[a] 303	417	323	1,182	568	355	295	164	[a] 69	
26	293	355	308	376	318	1,163	551	[a] 335	236	164	53	
27	293	354	293	[a] 358	312	1,140	536	316	210	164	11	
28	[a] 293	335	313	339	306	1,054	[a] 528	367	187	[a] 154	11	
29	292	[a] 329	313	401	......	992	520	368	164	143	11	[a]
30	282	323	[a] 307	368	......	959	520	[a] 362	[β] 165	130	11	
31	272	......	302	330	......	[a] 924	......	355	......	118	11	....
1907–8.												
1	578	525	[a]1,040	1,243	511	[a] 789	1,112	412	531	119	137	
2	588	483	970	1,218	[a] 572	866	1,080	394	535	119	[a] 149	
3	550	[a] 540	894	1,186	633	921	1,084	[a] 401	602	119	160	
4	590	597	814	1,186	640	829	1,128	409	588	[a] 119	135	
5	544	635	757	[a]1,173	586	879	[a]1,085	398	532	[a] 119	135	
6	[a] 513	706	691	1,161	578	861	1,042	374	582	119	188	[a]
7	482	918	656	1,108	568	910	980	376	[a] 512	119	201	[a]
8	586	1,040	[a] 641	1,091	484	[a] 955	969	461	442	119	155	
9	621	1,058	627	1,221	[a] 450	1,000	907	572	415	100	[a] 214	
10	710	[a]1,144	627	1,318	417	970	868	[a] 699	380	83	274	
11	728	1,231	735	1,250	397	1,027	935	826	366	83	319	
12	752	1,261	862	[a]1,343	366	1,045	[a] 868	805	289	[a] 83	309	
13	[a] 696	1,234	956	1,436	380	1,078	800	791	301	83	302	[a]
14	641	1,124	1,010	1,402	372	1,148	758	831	[a] 296	73	298	
15	577	1,064	[a] 985	1,479	627	[a]1,190	747	807	290	83	246	
16	515	1,004	959	1,435	[a] 959	1,233	721	709	231	83	[a] 261	
17	485	[a] 940	972	1,420	1,291	1,094	687	[a] 653	252	83	276	
18	422	875	905	1,386	1,247	1,015	725	598	226	83	255	
19	418	764	875	[a]1,226	1,172	1,098	[a] 680	528	153	[a] 83	214	
20	[a] 387	730	807	1,066	1,169	1,251	[a] 635	494	154	83	159	
21	357	689	733	1,017	1,137	1,290	590	451	[a] 136	83	214	
22	366	669	[a] 714	929	1,128	[a]1,305	553	429	119	83	161	
23	355	680	695	847	[a]1,092	1,319	545	468	119	83	[a] 188	
24	350	[a] 697	938	761	1,055	1,277	532	[a] 471	119	83	215	
25	325	713	[a]1,032	695	822	1,261	530	474	119	83	215	
26	318	821	1,125	[a] 756	725	1,257	[a] 497	487	119	[a] 130	189	
27	[a] 328	826	1,162	817	727	1,132	464	465	119	176	149	
28	337	[a] 976	1,150	794	692	1,219	449	429	[a] 119	189	136	
29	387	1,125	[a]1,172	756	712	[a]1,226	420	422	119	188	100	
30	484	1,110	1,193	561	......	1,234	394	[a] 458	119	187	[a] 123	
31	515	......	1,226	550	......	1,182	......	[a] 495	......	187	145	....

[a] Discharge interpolated.

oncord River at Lowell, Mass., for the years ending
, 1901–1915—Continued.

n.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
65	291	1,682	1,056	848	406	164	a 84	66
20	268	1,622	976	a 1,032	402	112	84	98
54	245	1,497	934	1,215	387	112	84	120
89	214	1,346	a 893	1,093	368	a 112	84	120
212	188	1,189	852	1,015	352	a 112	84	a 105
212	164	1,114	787	980	a 412	112	84	a 91
211	a 276	a 977	755	953	472	111	84	76
212	388	840	730	889	486	112	a 84	76
154	484	775	677	a 864	514	98	84	118
203	565	800	640	839	461	83	84	83
251	743	723	a 630	787	443	a 84	45	84
311	789	668	619	680	431	84	46	a 84
275	667	730	550	575	a 419	84	46	84
275	a 711	a 677	503	520	407	84	46	84
274	755	625	692	499	358	83	a 45	84
268	645	590	793	a 459	351	45	43	84
268	641	567	856	419	317	46	54	84
268	597	571	a 905	457	313	a 105	103	83
265	613	502	a 953	462	307	164	103	a 53
266	771	459	1,002	430	a 314	164	103	23
265	a 1,124	a 441	998	389	321	164	103	73
265	1,476	423	953	365	288	164	a 103	83
240	1,444	425	920	a 380	261	164	103	84
255	1,520	403	883	394	256	164	103	102
271	1,726	416	a 912	371	215	a 164	103	102
314	1,649	556	942	374	213	164	103	a 122
313	1,809	727	877	371	a 214	164	103	141
318	a 1,745	a 907	865	358	214	123	80	210
313	....	1,088	809	a 370	188	84	a 73	234
307	....	1,133	893	a 382	164	84	66	234
a 299	....	1,143	....	394	....	84	66	....
187	1,147	1,640	501	a 577	283	294	86	69
a 188	1,069	2,183	498	552	280	265	86	37
188	1,005	2,572	a 475	555	286	a 253	86	25
163	917	2,577	453	551	232	a 240	86	a 25
164	829	2,472	423	510	a 254	228	86	a 25
163	a 806	a 2,366	434	455	276	202	112	25
312	783	2,260	409	452	282	203	a 108	101
321	615	2,165	394	a 436	288	192	104	101
a 339	580	2,098	387	420	319	182	86	101
357	555	2,026	a 406	390	289	a 198	64	101
405	545	1,940	424	353	268	214	64	a 101
455	514	1,871	381	379	a 357	136	64	101
443	a 507	a 1,660	386	381	445	161	83	101
410	501	1,449	377	314	465	101	a 84	101
407	516	1,326	377	a 316	467	87	84	84
a 370	511	1,245	387	318	448	87	83	25
334	578	1,170	a 378	261	396	a 94	83	25
345	534	1,033	369	288	416	101	83	a 25
403	661	983	a 422	297	a 428	101	111	25
435	a 659	a 908	474	298	440	87	113	25
465	656	833	466	280	437	87	a 105	25
781	726	778	488	a 294	405	91	97	25
a 1,055	734	719	509	308	392	117	99	25
1,328	731	708	a 486	304	337	a 102	40	25
1,384	668	671	462	298	241	87	101	a 38
1,420	761	610	455	296	a 288	90	101	51
1,381	a 1,006	a 611	483	253	336	137	100	50
1,368	1,251	612	514	222	326	136	a 100	69
1,318	....	566	567	a 242	299	136	101	69
a 1,254	....	546	602	a 263	300	136	69	69
1,191	....	524	....	283	....	a 111	69	....

a Discharge interpolated.

Daily discharge, in second-feet, of Concord River at Lowell, Mass., for the years end
Sept. 30, 1901–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Se
1910-11.												
1	69	44	225	a 294	269	407	715	402	226	111	164	
2	a 69	45	219	319	269	417	a 686	378	187	a 73	164	
3	69	44	169	342	269	392	656	398	163	35	164	
4	69	44	a 199	377	256	366	638	357	a 142	a 27	135	a
5	69	156	228	356	a 321	a 344	608	343	120	19	135	a
6	69	a 211	233	329	386	321	646	344	118	16	a 135	
7	69	267	205	422	376	296	715	a 342	155	16	135	
8	69	251	184	a 407	385	295	749	340	170	16	135	
9	a 47	240	191	392	403	290	a 818	294	241	a 16	135	
10	25	229	146	300	380	280	887	294	255	16	135	a
11	20	264	a 140	334	341	281	928	294	a 261	16	118	
12	15	239	134	341	a 326	a 293	903	223	268	16	101	
13	20	a 254	135	310	311	305	874	238	267	16	a 100	
14	20	269	135	350	283	303	849	a 238	255	16	100	
15	21	250	142	a 302	252	392	849	239	254	16	100	
16	a 22	249	106	254	247	511	a 805	239	254	a 16	100	
17	23	215	112	260	240	483	760	239	266	16	100	
18	25	227	a 122	215	214	517	661	232	a 260	16	100	
19	25	180	131	236	a 230	a 623	635	213	253	16	100	
20	26	a 211	163	204	247	729	608	211	253	16	a 97	
21	42	242	139	178	245	770	598	a 215	231	16	94	
22	58	219	106	a 177	244	770	614	219	216	16	80	
23	a 44	212	88	176	283	745	a 581	219	212	a 24	88	
24	30	a 219	127	164	263	710	549	215	202	32	88	
25	54	226	a 216	172	256	674	534	212	a 206	59	93	
26	65	219	a 306	160	a 303	a 650	504	213	210	77	88	
27	140	a 202	395	150	350	626	466	213	183	56	a 87	
28	163	196	330	257	408	570	437	a 195	131	56	87	
29	153	187	337	a 307	......	574	443	176	100	55	98	
30	a 116	197	330	356	......	655	a 423	a 201	92	a 110	148	
31	79	......	268	254	......	693	......	226	......	164	184	...
1911-12.												
1	a 132	278	514	604	322	1,196	1,649	720	713	187	157	
2	164	275	502	527	304	1,198	1,695	715	a 723	151	107	
3	119	261	a 494	502	346	a 1,059	1,702	659	733	137	182	
4	165	254	496	469	a 333	921	1.734	605	690	a 160	a 191	
5	187	a 246	407	441	319	894	1,734	a 584	706	122	200	
6	187	238	391	328	306	849	1,750	562	625	140	159	
7	187	267	371	a 339	303	786	a 1.666	562	540	a 131	135	
8	a 187	254	350	350	308	753	1.582	577	513	122	123	a
9	187	254	333	349	305	713	1,518	587	a 462	69	89	
10	188	255	a 338	349	297	a 669	1,481	747	412	69	85	
11	188	255	342	354	a 303	626	1,411	745	380	69	a 95	
12	a 188	a 256	330	345	308	596	1.347	a 812	361	101	104	
13	187	256	339	342	255	956	1,323	879	349	101	115	
14	187	256	320	a 333	232	1,214	a 1.175	888	356	a 111	136	
15	a 187	300	324	325	219	1,614	1,028	814	363	122	157	a
16	187	312	332	322	191	2,102	973	759	a 357	153	127	
17	188	339	a 396	306	184	a 2,250	904	853	351	121	136	
18	188	379	459	309	a 190	2,399	906	838	327	131	a 169	
19	188	a 446	484	337	196	2,371	a 965	a 848	326	158	203	
20	188	513	466	373	221	2,220	a 1,024	859	291	156	174	
21	216	510	434	a 405	249	2,090	a 1,083	806	295	a 195	159	
22	a 272	472	387	437	a 494	1,938	1,142	764	285	234	150	a
23	327	461	502	423	738	1,696	1,152	754	a 284	233	150	
24	327	448	a 583	449	813	a 1,696	1,108	735	282	238	150	
25	334	512	a 664	417	a 919	1,697	1,021	704	267	237	a 135	
26	332	a 519	745	380	1,025	1,572	964	a 754	246	214	120	
27	323	526	753	390	1,060	1,357	885	805	214	173	123	
28	324	524	776	a 377	1,207	1,217	a 827	807	192	a 185	125	
29	a 310	526	693	364	1,195	1,267	769	753	197	197	131	a
30	296	a 520	707	322	......	1,600	732	a 720	a 192	203	100	
31	272	......	a 656	325	......	a 1,625	......	688	......	202	91	...

a Discharge interpolated.

Concord River at Lowell, Mass., for the years ending
0, 1901–1915—Continued.

an.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
670	512	679	1,593	754	[a]765	184	114	[a]114
806	[a]507	[a]740	1,463	744	756	180	113	124
877	502	802	1,306	790	738	175	[a]72	113
962	438	889	1,167	[a]702	673	[a]166	31	112
[a]860	429	834	1,015	614	593	[a]157	126	118
758	411	771	[a]1.072	570	517	[a]147	162	[a]124
751	388	708	1,128	552	596	138	161	124
787	415	721	1,046	519	[a]507	116	161	123
765	[a]385	[a]674	988	477	418	110	160	124
678	354	626	923	478	377	100	[a]89	118
591	367	654	845	[a]439	354	100	18	112
[a]648	334	642	863	399	359	111	18	112
706	344	596	[a]1,070	393	350	[a]111	51	112
696	318	604	1,277	380	327	111	126	[a]115
694	317	652	1,333	346	[a]323	100	97	117
706	[a]320	[a]764	1,433	345	319	106	58	99
669	324	875	1,582	347	280	96	[a]58	92
655	314	818	1,537	[a]347	280	100	59	99
[a]650	318	764	[a]1,497	346	218	95	86	118
645	315	836	[a]1,456	346	233	[a]91	114	87
597	316	904	1,416	335	239	87	114	[a]117
647	[a]375	976	1,319	316	[a]249	80	58	147
653	[a]433	[a]980	1,234	328	259	80	58	188
627	492	984	1,190	397	251	80	[a]86	223
595	501	929	1,097	[a]527	217	87	114	255
[a]607	512	944	1.009	656	229	87	113	255
620	522	1,034	[a]966	694	219	[a]53	113	247
575	603	1,285	923	728	220	18	85	[a]243
536	....	1,347	845	790	[a]210	19	85	239
530	....	[a]1,475	822	[a]782	201	44	[a]95	220
522	....	1,603	....	[a]773	....	82	105	....
514	[a]1,050	[a]634	1,201	1,064	328	174	150	184
402	1,334	922	1,081	1,064	331	175	[a]137	183
409	1,319	1,515	1,202	[a]1,055	290	225	123	194
[a]399	1,301	1,887	1,149	1,046	298	[a]229	138	161
389	1,221	2,411	[a]1,232	972	266	[a]232	165	161
366	1,106	2,327	1,314	1,022	263	236	165	[a]161
366	966	2,099	1,234	1,069	[a]285	253	164	[a]162
372	[a]928	[a]1,812	1,311	1,018	307	258	165	162
364	889	1,525	1,376	1,056	307	258	[a]177	162
373	910	1,139	1,390	[a]1,082	282	257	190	169
[a]362	830	1,180	1,341	1,108	262	258	188	107
352	720	1,257	[a]1,298	1,030	261	[a]257	148	85
248	615	1,204	1,254	971	257	256	137	[a]105
242	597	1,344	1,107	1,048	[a]253	256	176	125
287	[a]486	[a]1,205	1,022	1,023	248	214	189	111
346	374	1,066	1,035	967	237	214	[a]189	111
335	343	1,004	1,047	[a]965	217	215	189	110
[a]323	414	969	1,107	962	217	213	149	111
310	338	951	[a]1,068	904	191	[a]213	80	111
312	398	898	[a]1,028	849	191	212	80	[a]111
290	327	798	989	786	[a]201	200	90	111
286	[a]338	[a]831	906	761	211	161	189	111
265	[a]348	865	823	777	213	94	[a]208	111
314	359	777	783	[a]659	212	101	227	85
[a]395	340	650	768	541	175	106	215	62
476	352	588	[a]859	448	132	[a]124	218	61
578	375	621	950	464	111	142	208	[a]61
668	345	708	1,006	421	[a]128	169	184	62
738	....	[a]994	1,017	400	145	134	192	62
731	....	1,280	1,035	[a]376	175	80	[a]195	62
766	....	1,280	....	[a]352	....	103	199	....

[a] Discharge interpolated.

Daily discharge, in second-feet, of Concord River at Lowell, Mass., for the years endi
Sept. 30, 1901-1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Se
1914-15.												
1	62	a 112	214	191	653	1,328	262	244	187	134	a 348	
2	62	111	214	192	566	1,273	261	a 251	182	258	336	
3	62	111	215	a 225	487	1,170	261	259	183	350	341	
4	a 62	113	215	258	391	1,071	a 260	329	137	a 400	389	
5	62	113	216	236	377	999	259	338	131	a 449	502	a
6	62	112	a 215	178	472	891	298	290	a 135	499	681	a
7	62	112	215	257	a 534	a 800	299	305	138	518	787	
8	62	a 112	200	343	596	708	296	251	138	514	a 984	
9	62	113	187	295	669	675	296	a 280	138	533	1,180	
10	61	113	187	a 313	663	614	194	308	118	784	1,197	
11	a 61	112	186	331	679	552	a 283	308	106	a 782	1,186	
12	a 62	112	187	350	684	509	372	308	106	779	1,092	a
13	62	113	a 205	585	734	462	327	257	a 106	722	1,064	
14	62	113	224	695	a 737	a 462	353	257	106	670	1,007	
15	62	a 152	246	772	740	461	341	245	106	613	a 940	
16	61	190	263	831	965	410	328	a 243	69	676	874	
17	61	190	264	a 818	1,154	361	327	242	63	635	772	
18	a 74	190	277	805	1,127	326	a 315	227	56	a 584	694	
19	87	190	282	1,026	1,274	337	a 303	217	65	532	620	a
20	125	190	a 268	1,370	1,375	326	291	207	a 67	509	547	
21	177	190	253	1,482	a 1,266	a 299	297	228	70	465	521	
22	150	a 189	253	1,468	a 1,156	271	305	186	70	438	a 496	
23	111	189	251	1,440	1,047	294	295	a 212	101	393	470	
24	101	215	225	a 1,377	1,000	267	288	237	69	324	433	
25	a 107	215	a 215	1,314	1,070	274	a 290	237	69	a 353	413	
26	112	a 215	a 205	1,240	1,152	283	291	232	70	382	420	a
27	112	215	a 196	1,164	1,176	288	285	233	a 91	322	376	
28	112	156	186	1,095	a 1,252	a 288	258	212	112	305	354	
29	113	a 186	137	990	....	288	242	184	112	305	a 346	
30	113	215	138	990	....	278	238	a 185	111	269	338	
31	112	....	162	a 882	....	260	....	a 186	....	360	340	....

a Discharge interpolated.

Monthly discharge of Concord River at Lowell, Mass., for the years ending Sept.
1901-1915.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1901.			
January	365	259	295
February	279	115	199
March	1,709	193	907
April	3,062	1,182	1,878
May	2,084	936	1,444
June	2,030	262	761
July	371	194	256
August	390	204	308
September	361	207	255
1901-2.			
October	517	233	318
November	558	246	317
December	1,770	215	797
January	1,868	475	951
February	841	212	509
March	4,148	1,170	2,147
April	1,656	534	1,002
May	670	270	448
June	347	188	238
July	243	74	160
August	316	110	199
September	252	99	182
The year.	4,148	74	608

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean
1902-3.			
October	530	272	
November	791	276	
December	1,204	253	
January	1,159	484	
February	1,277	682	
March	1,837	1.116	
April	1,718	604	
May	529	227	
June	2,521	209	
July	1,460	297	
August	334	141	
September	214	136	
The year.	2,521	136	
1903-4.			
October	459	99	
November	394	238	
December	433	234	
January	309	187	
February	468	196	
March	1,490	420	
April	1,959	478	
May	2,861	354	
June	403	198	
July	342	106	

er at Lowell, Mass., for the years ending Sept. 30, 11-1915—Continued.

-feet.	
	Mean.
	230
	234
	459
	226
	242
	134
	545
	236
	854
	817
	301
	268
	165
	149
	560
	375
	251
	246
	396
	547
	474
	1,011
	1,252
	456
	636
	364
	322
	138
7	507
8	174
8	343
9	278
9	689
6	352
3	717
0	675
6	402
4	350
8	176
1	77
31	225
11	371
18	500
33	873
27	901
50	1,091
66	742
89	1,092
94	760
74	535
19	296
83	111
00	201
25	92
25	600
24	78
64	205
65	218
20	249
64	804

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1908-9—Contd.			
March	1,682	403	826
April	1,056	503	829
May	1,215	358	618
June	514	164	342
July	164	45	116
August	103	43	80
September	234	23	103
The year	1,800	23	369
1909-10.			
October	235	101	156
November	336	120	208
December	346	187	269
January	1,420	163	624
February	1,251	501	727
March	2,577	524	1,391
April	602	369	416
May	577	222	360
June	467	232	343
July	294	87	150
August	113	64	88
September	101	25	56
The year	2,577	25	399
1910-11.			
October	163	15	58
November	269	44	200
December	395	88	192
January	422	150	280
February	403	214	298
March	770	280	493
April	928	423	671
May	402	176	263
June	268	92	205
July	164	16	38
August	184	80	116
September	186	83	126
The year	928	16	244
1911-12.			
October	334	119	223
November	526	238	364
December	776	320	480
January	604	306	384
February	1,207	184	453
March	2,399	596	1,392
April	1,750	732	1,242
May	888	562	739
June	733	192	401
July	238	69	156
August	203	81	138
September	140	80	115
The year	2,399	80	507
1912-13.			
October	272	25	134
November	325	188	275
December	597	246	329
January	962	522	680
February	603	314	406
March	1,603	596	875
April	1,593	822	1,180
May	790	316	523
June	765	201	376
July	184	18	104
August	162	18	94
September	255	87	146
The year	1,603	18	426

Monthly discharge of Concord River at Lowell, Mass., for the years ending Sept. 30 1901–1915—Continued.

Month.	Discharge in second-feet.			Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.		Maximum.	Minimum.	Mean.
1913–14.				1914–15.			
October	355	210	264	October	177	61	8
November	352	310	335	November	215	111	155
December	597	340	437	December	282	137	216
January	766	242	406	January	1,482	178	758
February	1,334	327	676	February	1,375	377	857
March	2,411	621	1,185	March	1,328	260	543
April	1,390	768	1,098	April	372	194	291
May	1,108	352	847	May	338	184	248
June	331	111	233	June	187	56	107
July	258	80	194	July	784	134	479
August	227	80	169	August	1,197	336	647
September	184	61	119	September	333	138	215
The year	2,411	61	496	The year	1,482	56	382

NOTE.—Run-off in second-feet per square mile not computed on account of uncertainty in regard to amount of waste water received from Sudbury River basin.

Days of deficiency in discharge of Concord River at Lowell, Mass., during the years ending Sept. 30, 1901–1915.

Discharge in second-feet.	Days of deficiency in discharge.														
	1901 [a]	1901–2	1902–3	1903–4	1904–5	1905–6	1906–7	1907–8	1908–9	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15
50	.....	.....	.....	4	.....	1	5	12	21	16	41	.....	9	.....	.....
100	.....	4	.....	8	22	10	26	32	65	50	82	11	38	13	30
150	7	25	11	24	53	12	50	66	110	94	133	64	100	41	75
200	15	71	25	51	124	40	96	89	148	130	171	110	111	76	121
250	64	113	56	137	174	70	135	98	194	169	228	128	136	121	164
300	126	170	90	179	218	112	158	107	223	204	269	151	173	144	215
350	151	191	152	224	266	165	216	115	236	230	295	197	216	199	249
400	171	208	186	259	283	188	255	132	253	249	312	216	229	233	263
500	174	228	203	288	298	240	296	159	276	286	324	237	242	252	279
600	177	249	214	292	309	281	316	193	288	308	333	259	265	264	294
700	181	268	230	303	319	298	327	218	301	318	348	270	291	270	309
800	182	276	246	308	324	309	333	243	315	327	357	296	314	282	320
900	187	288	257	312	330	315	339	269	329	330	363	312	327	290	327
1,000	193	300	269	321	334	323	348	289	342	333	365	320	338	306	333
1,250	213	321	313	341	348	340	360	348	354	342	.....	337	349	344	353
1,500	230	329	336	358	357	354	365	366	358	352	.....	343	361	358	365
2,000	257	347	360	361	364	365	.....	.....	365	356	.....	360	365	362	.....
2,500	268	358	363	364	365	.....	.....	.....	.....	363	.....	366	.....	365	.....
3,000	272	361	365	366	.....	.....	.....	.....	.....	365	.....	.....	.....	.....	.....
4,000	273	364	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5,000	.....	365	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[a] Jan. 1 to Sept. 30, 1901.

NOTE.—The above table shows the number of days on which the discharge was less than the amounts given in the column for discharge. In using this table, allowance should be made for the varoius losses, the principal ones being the wheel loss, which may be as large as 20 per cent, and the head loss, which may be as large as 5 per cent.

E COCHITUATE BASINS NEAR FRAM-
D COCHITUATE, MASS.

udbury River and Lake Cochituate basins have
times in connection with changes in the water-
olitan district. Area of Sudbury basin from 1875
e miles; 1879–1880, 78.2 square miles; 1881–1915,
chituate basin from 1863 to 1909, inclusive, 18.87
e miles; 1911–1915, 17.58 square miles.
River basin, January, 1875, to September, 1915;
ry, 1863, to September, 1915. Sudbury River and
tudied by the engineers of the city of Boston, the
achusetts, and the Metropolitan Water and Sewer-
have been kept in the Sudbury basin since 1875
ince 1852, but Cochituate records prior to 1872 are

f the flow from these basins is controlled by storage
e city of Boston and the Metropolitan Water and
ituate, which drains into Sudbury River a short
is controlled as a storage reservoir by the Metropoli-
dbury River basin the water surfaces exposed to
ased from time to time by the construction of addi-
From 1875 to 1878, inclusive, the water surface
the total area; from 1879 to 1884, to 3 per cent; 1885
o 3.9 per cent; 1898 and subsequent years, 6.5 per

—In determining the run-off of the Sudbury and
the water diverted for the municipal supply of
Vestboro, which discharge their sewerage outside the
ration; the results, however, are probably less accu-
ersion works were constructed. The public water
stalled in these towns as follows:

sewerage works in Framingham, Natick, and Westboro.

Town.	Water supply.	Sewerage works.
....	1885	1889
....	1874	1896
....	1879	1892

ett drainage basin passes into the reservoirs in the
be measured to determine the yield of the Sudbury
estimates of the Sudbury water supply during months
quent to 1897 is impaired by the errors unavoidable in
rger quantities of water from the Wachusett basin.
rds for calendar years furnished by the Metropolitan
of Boston; changed to the climatic year by engineers

Yield, in second-feet per square mile, of Sudbury River basin,[a] near Framingham, Mas
for the years ending Sept. 30, 1875–1915.

Year.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Mea
1874–75..	....	....	....	0.159	2.315	2.482	4.718	1.838	1.346	0.497	0.612	0.321	....
1875–76..	1.000	2.015	0.903	.995	2.116	6.862	5.094	1.761	.343	.283	.627	.285	1.8
1876–77..	.361	1.683	.702	1.019	1.469	7.448	3.703	2.153	.924	.312	.187	.092	1.6
1877–78..	.977	2.193	1.995	2.800	3.814	5.426	2.516	2.158	.782	.199	.736	.249	1.9
1878–79..	.799	2.619	4.916	1.083	2.647	3.605	4.821	1.723	.640	.243	.611	.218	1.9
1879–80..	.109	.318	.716	1.733	2.765	2.126	1.808	.796	.271	.273	.184	.124	.9
1880–81..	.157	.318	.271	.642	2.392	6.195	2.392	1.493	2.070	.428	.229	.305	1.4
1881–82..	.287	.611	1.199	1.920	3.718	4.392	1.342	1.998	.818	.133	.086	.474	1.4
1882–83..	.463	.324	.487	.518	1.598	2.492	2.088	1.450	.464	.178	.122	.141	.8
1883–84..	.288	.317	.299	1.540	4.397	5.857	4.415	1.594	.644	.346	.397	.068	1.6
1884–85..	.129	.271	1.431	1.910	2.095	2.433	2.808	2.067	.659	.096	.372	.187	1.2
1885–86..	.519	1.822	1.816	2.260	7.428	3.185	3.013	1.114	.314	.179	.146	.182	1.7
1886–87..	.225	1.041	1.578	4.006	4.377	4.437	4.053	1.561	.640	.178	.331	.172	1.8
1887–88..	.294	.570	.995	1.629	3.011	5.009	4.093	2.526	.652	.182	.587	1.786	1.7
1888–89..	3.093	4.267	4.708	4 305	1.850	2.071	2.182	1.361	1.011	.980	2.216	1.274	2.4
1889–90..	1.903	3.003	3.467	1.941	2.366	5.636	2.900	2.114	.878	.166	.204	.708	2.1
1890–91..	3.515	1.879	1.541	4.669	5.393	6.891	3.709	.901	.639	.231	.252	.314	2.4
1891–92..	.325	.472	.842	2.893	1.459	3.025	1.348	1.947	.662	.331	.433	.355	1.1
1892–93..	.195	1.079	.750	.671	2.386	5.021	3.288	4.461	.680	.244	.280	.167	1.5
1893–94..	.343	.493	1.252	1.072	1.533	3.463	2.538	1.299	.648	.249	.324	.231	1.1
1894–95..	.579	1.293	1.108	1.600	.837	3.728	3.892	.984	.269	.357	.354	.138	1.2
1895–96..	2.134	4.296	2.757	1.677	4.140	5.933	2.312	.557	.617	.147	.088	.600	2.0
1896–97..	.916	1.020	1.017	1.307	1.651	3.968	2.344	1.416	1.488	1.018	.914	.282	1.4
1897–98..	.145	1.407	2.451	2.535	4.676	4.029	2.830	1.927	.820	.357	1.712	.571	1.9
1898–99..	1.795	3.073	2.783	3.541	2.137	6.507	3.900	.790	.102	.030	−.054	.145	2.0
1899–1900	.179	.474	.340	1.229	5.880	5.653	2.088	2.031	.489	−.028	−.052	.101	1.5
1900–1901	.287	1.026	1.696	.676	.464	4.262	6.504	4.570	1.165	.473	.655	.473	1.8
1901–2...	.637	.734	4.170	2.728	2.590	6.497	2.916	1.149	.469	.101	.208	.276	1.8
1902–3...	.782	.688	2.753	2.685	3.526	5.344	3.498	.542	3.075	.689	.475	.201	2.0
1903–4...	.761	.561	.901	.738	1.365	4.640	5.096	2.699	.648	.096	.262	.614	1.5
1904–5...	.295	.447	.417	2.182	.510	3.864	2.543	.460	.723	.275	.177	1.928	1.1
1905–6...	.245	.431	1.373	1.745	1.610	3.727	3.015	1.639	1.093	.615	.279	.030	1.3
1906–7...	.466	.747	1.019	2.091	.965	2.565	2.487	1.374	1.178	.014	−.161	.837	1.1
1907–8...	1.146	3.092	3.143	2.978	2.377	3.492	1.729	1.618	.301	−.022	.157	−.127	1.6
1908–9...	.072	.110	.210	.607	3.537	2.683	2.662	1.553	.370	−.187	−.069	.231	.9
1909–10..	−.079	.127	.407	2.305	2.861	3.023	1.031	.429	.799	−.158	−.113	.008	.8
1910–11..	−.078	.273	.342	.802	1.084	1.771	2.206	.492	.329	−.022	.032	.117	.6
1911–12..	.458	.918	1.405	1.127	1.852	4.783	3.459	2.238	.229	−.119	−.046	−.044	1.3
1912–13..	−.021	.255	.765	1.611	1.166	3.233	3.453	1.342	.230	−.096	−.083	.136	.9
1913–14..	.749	.743	1.132	1.405	1.561	4.686	3.640	2.398	.007	.165	.241	−.210	1.3
1914–15..	−.091	.151	.387	2.520	2.893	.918	.912	.395	.156	1.617	1.808	.059	.9

[a] See statement in station description.

Summary of yield and rainfall in Sudbury River basin near Framingham, Mass., for th
years ending Sept. 30, 1876–1915.

[Drainage area,[a] 75.2 square miles.]

Month.	Yield.					Average rainfall in inches.
	Total in million gallons.	Per square mile.		Average depth in inches on drainage area.	Per cent of rainfall.	
		Million gallons per day.	Second-feet.			
1876–1915.						
October	39,711.9	0.426	0.659	0.760	19.7	3.8
November	68,760.6	.762	1.179	1.315	34.7	3.7
December	91,040.0	.976	1.510	1.741	45.7	3.8
January	114,048.8	1.223	1.892	2.181	52.4	4.1
February	143,355.2	1.687	2.610	2.740	66.4	4.1
March	257,468.6	2.761	4.272	4.925	113.8	4.3
April	175,882.2	1.949	3.016	3.365	95.4	3.5
May	98,052.9	1.052	1.628	1.877	57.4	3.2
June	41,261.7	.457	.707	.789	27.2	2.9
July	15,900.1	.172	.266	.307	8.4	3.6
August	22,763.7	.244	.378	.436	11.1	3.9
September	19,973.1	.221	.342	.382	11.5	3.3
The year	1,088,218.8	.991	1.533	20.818	46.6	44.6

[a] Although the drainage area has been changed at different times, figures in this table have been computed from the present drainage area.

of Lake Cochituate basin,[a] *near Cochituate, Mass.,*
nding Sept. 30, 1863–1915.

	›.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Mean.
	92	3.221	3.955	1.252	0.595	2.553	1.334	0.886	......
	45	3.550	2.374	1.400	.436	.357	.585	.440	1.508
	90	4.041	2.421	4.121	.298	.396	.414	.397	1.582
	26	1.544	1.452	1.123	.974	1.092	.554	1.181	1.136
	28	3.014	2.567	1.891	.594	.486	1.820	.279	1.617
	035	3.339	3.131	5.358	1.430	.395	.985	1.633	1.775
	791	2.888	2.227	1.882	.939	.642	.513	.995	1.419
	790	2.926	6.152	1.440	.870	.464	.347	.575	2.204
	195	2.199	1.412	1.733	.782	.373	.604	.255	1.049
	827	1.172	2.655	.951	1.331	.124	1.146	1.522	1.108
	.511	3.378	5.458	2.311	.406	.535	1.215	.700	1.875
	.104	1.597	2.859	2.410	1.753	.821	.800	.477	1.772
	.807	2.308	2.823	1.209	1.327	.220	.538	.534	1.092
	.656	4.507	3.766	1.236	.453	.735	.254	.519	1.491
	1.318	5.907	2.907	1.765	.823	.560	.568	.362	1.509
	3.813	4.684	2.559	1.439	.693	.406	.725	.259	1.862
	2.234	2.860	4.019	1.218	.689	.283	.820	.546	1.642
	2.078	1.553	1.405	.382	.051	.283	.202	.217	.788
	2.140	4.905	1.607	1.093	1.170	.139	.074	.206	1.137
	2.885	3.185	.836	1.345	.556	.052	.062	.865	1.116
	1.526	1.769	1.487	1.091	.060	.015	.063	.392	.760
	2.656	4.053	3.581	1.203	.603	.227	.530	.120	1.338
	1.919	1.916	2.114	1.401	.383	.000	.291	.227	1.022
	7.615	3.046	2.261	.943	.172	.217	.117	.266	1.670
	4.168	4.080	3.011	1.171	.735	.625	1.149	.574	1.844
	2.568	4.129	3.090	2.056	.478	.407	.815	2.072	1.534
	1.778	1.809	1.947	1.038	1.055	1.413	2.973	1.604	2.362
	1.955	5.092	1.999	1.608	1.261	.284	.402	1.255	1.888
	6.360	6.965	3.865	.764	.690	.432	.626	.682	2.669
	1.446	2.618	.808	1.758	.442	.286	.483	.543	1.131
5	2.450	3.577	2.177	1.585	.671	.330	.669	.378	1.208
3	1.607	2.210	1.927	.789	.403	.325	.359	.407	.999
8	.721	3.032	2.997	.841	.364	.486	.429	.621	1.106
4	3.419	4.791	1.805	.541	.639	.325	.410	.923	1.766
1	1.588	2.792	1.659	1.207	1.067	.653	.542	.410	1.235
71	3.894	2.700	2.414	1.615	.700	.321	1.129	.278	1.549
91	2.223	5.505	2.545	.599	.102	.028	.079	.449	1.697
60	4.136	4.020	1.454	1.641	.455	.293	.558	.640	1.283
40	.629	3.845	4.649	3.704	1.019	.792	1.101	1.012	1.746
71	1.934	6.022	2.741	.955	.319	.398	.604	.688	1.709
184	2.734	4.311	3.106	.689	2.132	.553	.408	.130	1.644
910	1.167	4.108	4.695	2.032	.489	.059	.398	.901	1.420
824	.422	3.127	2.064	.531	.643	.180	.571	1.647	1.073
363	1.226	3.017	2.388	1.395	.772	.640	.490	.429	1.225
645	.903	2.061	1.964	1.238	.902	.108	.252	.952	1.016
.049	2.412	2.946	1.525	1.331	.315	.245	.184	−.030	1.401
.633	3.191	2.125	2.145	1.218	.598	.181	.432	.658	.967
.424	2.807	2.412	1.147	.603	1.024	.252	.013	.101	.982
.768	1.173	1.736	1.943	.251	.116	.052	.487	.549	.663
.981	1.783	4.262	3.025	2.245	.417	.062	.118	.351	1.388
1.685	1.278	3.126	3.059	1.429	.376	−.011	.284	.491	1.137
1.566	1.629	4.831	3.392	2.208	.216	.276	.208	−.148	1.430
2.874	3.408	.992	.899	.351	.141	1.623	1.605	.150	1.066

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[a] See statement in station description.

Summary of yield and rainfall in Lake Cochituate basin near Cochituate, Mass., for years ending Sept. 30, 1864–1915.

[Drainage area, [a] 17.58 square miles.]

Month.	Yield.					Averag rainfall i inches.
	Total in million gallons.	Per square mile.		Average depth in inches on drainage area.	Per cent of rainfall.	
		Million gallons per day.	Second-feet.			
1864–1915.						
October	15,009.3	0.530	0.819	0.95	23.1	4.
November	20,707.9	.755	1.171	1.30	32.8	3.
December	25,707.7	.907	1.407	1.62	45.3	3.
January	31,422.3	1.109	1.716	1.98	50.4	3.
February	39,003.1	1.511	2.238	2.45	62.8	3.
March	60,787.5	2.145	3.319	3.83	89.3	4.
April	45,181.7	1.647	2.548	2.84	81.9	3.
May	26,889.0	.949	1.468	1.69	47.2	3.
June	12,042.9	.439	.679	.76	25.7	2.
July	7,199.2	.254	.393	.45	11.9	3.
August	10,920.2	.385	.596	.69	16.7	4.
September	10,799.7	.394	.610	.68	19.1	3.
The year	305,670.5	.915	1.416	19.24	42.6	45.

[a] Used as a basis of computations in table. See "Drainage area" in station description. Figures summary represent average quantities.

MISCELLANEOUS MEASUREMENTS.

The results of discharge measurements of streams in Massachu setts at points other than regular gaging stations are presented i the following list:

Miscellaneous measurements on streams in Massachusetts.

Connecticut River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Dis-charg
				Feet.	*Sec.-f*
1914. July 24	Canal		Erving		[a] 145
1906. Oct. 18	Ware River	Chicopee River	Bridge at Barre station		104
1910. July 22	do	do	do		102
22	do	do	do		368
Sept. 13	do	do	do		7.
1911. Mar. 8	do	do	do		232
1909. Aug. 6	Swift River	do	Three-fourths mile below Enfield.		89.
6	Middle Branch of Swift River.	Swift River	1½ miles from Enfield		24.
1906. Oct. 19	Quaboag River	Chicopee River	Highway bridge near Palmer		110
1909. Aug. 4	Middle Branch of Westfield River.	Westfield River	Mouth		[b] 5.
26	do	do	Bridge ½ mile above mouth		15
Oct. 11	do	do	do		6.

[a] Water diverted from Millers River and used by two wheels in chair factory. [b] Estimated.

on streams in Massachusetts—Continued.

t River basin—Continued.

y to—	Locality.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
r...............	One-half mile above Huntington.	....	34.5
....	Highway bridge at Huntington.	....	23.8
....	.....do......................	....	69.1
....	Highway bridge near Westfield.	....	5.5
....	Town of Little River........	1.00	25.6
....	.....do......................	.97	20.9

uinebaug River basin.

River............	Dam at Perryville..........	3.83	100
....	.....do......................	3.73	59

ufacturing Associates plant on Chicopee River at Red ge, Mass., during 1913–14.

[Made by C. H. Pierce.]

	Wheel-gate openings.
3	1.00 opening on unit No. 1.
5	.605 opening on unit No. 1.
7	.43 opening on unit No. 1.
18	.70 opening on unit No. 4.
36	.85 opening on unit No. 4.
08	1.00 opening on unit No. 4.
06	.58 opening on unit No. 4.
56	.26 opening on unit No. 1.
74	.575 opening on unit No. 5.
28	Gates all closed.
252	0.74 opening on unit No. 4.
255	.52 opening on unit No. 3.
289	.64 opening on unit No. 2.
412	1.00 opening on unit No. 4.
330	.90 opening on unit No. 4.
72	.38 opening on unit No. 5.
376	1.00 opening on unit No. 3.
396	1.00 opening on unit No. 2.
199	.61 opening on unit No. 4.
74	.91 opening on unit No. 5.
69	.5+ opening on unit No. 5.
125	.37 opening on unit No. 4.
114	.15 opening on unit No. 1.
[a] 169	Flow over dam and wasteway.

[a] Head on dam 0.26 foot.

re made at the Ludlow Manufacturing Associates power plant. Units onstruction and consist of two 36-inch wheels set tandem on horizontal lowatt generators of the General Electric Co. class 20, 1,000 kilowatts, wheel gates of piston type. Unit No. 4 is of similar construction except acity, being of the General Electric Co. class 16, 1,200 kilowatts, 300 revo- wheel gates of swing type. Unit No. 5 consists of two 15-inch wheels set

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydrauli computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inch over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.03719	1.041	1.079	1.116	1.153
2.........	.07438	2.083	2.157	2.231	2.306
3.........	.11157	3.124	3.236	3.347	3.459
4.........	.14876	4.165	4.314	4.463	4.612
5.........	.18595	5.207	5.393	5.578	5.764
6.........	.22314	6.248	6.471	6.694	6.917
7.........	.26033	7.289	7.550	7.810	8.070
8.........	.29752	8.331	8.628	8.926	9.223
9.........	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.0864	2.419	2.506	2.592	2.678
2.........	.1728	4.838	5.012	5.184	5.356
3.........	.2592	7.257	7.518	7.776	8.034
4.........	.3456	9.676	10.02	10.37	10.71
5.........	.4320	12.10	12.53	12.96	13.39
6.........	.5184	14.51	15.04	15.55	16.07
7.........	.6048	16.93	17.54	18.14	18.75
8.........	.6912	19.35	20.05	20.74	21.42
9.........	.7776	21.77	22.55	23.33	24.10

NOTE.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.........	0.6463	18.10	18.74	19.39	20.04
2.........	1.293	36.20	37.48	38.78	40.08
3.........	1.939	54.30	56.22	58.17	60.12
4.........	2.585	72.40	74.96	77.56	80.16
5.........	3.232	90.50	93.70	96.95	100.2
6.........	3.878	108.6	112.4	116.3	120.2
7.........	4.524	126.7	131.2	135.7	140.3
8.........	5.171	144.8	149.9	155.1	160.3
9.........	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the run-off for 1 day by the number of days *feet per second into velocity in miles per hour.*

two-thirds mile per hour, very nearly; 1 mile per hour=1.4666
the table the values 0.68182 and 1.4667 were used.]

iles per hour for tenths of foot per second.

	3	4	5	6	7	8	9
.36	0.205	0.273	0.341	0.409	0.477	0.545	0.614
18	.886	.995	1.02	1.09	1.16	1.23	1.30
50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

second-feet into theoretical horsepower per foot of fall.

wer per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.]

Units.							
2	3	4	5	6	7	8	9
0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

fornia miner's inches (law of Mar. 23, 1901).
olorado miner's inches.
zona miner's inches.
United States gallons per second; equals 448.8 gallons
allons for one day.
(365 days) covers 1 square mile 1.131 feet, or 13.572 inches

(365 days) equals 31,536,000 cubic feet.
t 1 acre-inch per hour.
: (365 days) equals 724 acre-feet.
equals 86,400 cubic feet.
States billion) cubic feet equals 11,570 second-feet for one

equals 414 second-feet for one 28-day month.
equals 399 second-feet for one 29-day month.
equals 386 second-feet for one 30-day month.
, equals 373 second-feet for one 31-day month.
nches equals 18.7 United States gallons per second.
nches for one day equals 4.96 acre-feet.
ches equals 2.60 second-feet.
nches equals 19.5 United States gallons per second.
nches for one day equals 5.17 acre-feet.

100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower
water wheel realizing 80 per cent of theoretical power.

GAZETTEER OF STREAMS.

The streams, lakes, and ponds described in the following pag comprise all that are named on the topographic maps of Massachuset surveyed and published by the United States Geological Survey cooperation with the Commonwealth between 1884 and 1907. T first editions of many of these maps were exhausted, and those th have been reprinted were revised so far as possible to embody chang in cultural features. As the descriptions are based chiefly on t maps they vary in accuracy as the maps vary.

Each stream is described as rising near the point at which the he of the upper tributary apparently draining the largest area is sho on the map, and the elevation of that point is given as the elevati of the source. It is, of course, recognized that this method does n give results of great precision, but it probably causes no grea errors in the determination of length and fall than would be caus by extending each stream to the head of the divide between its bas and that of the adjoining streams. It should be understood, ho ever, that all statements of elevation, length, and fall are mere approximate.

The maps used, which are sheets of the Survey's topograp atlas, are listed below, and an index map showing the area cover

ıed by applying to the Director, United
ashington, D. C.:

- ɔck, Mass.-Vt.
- n, Mass.-N. H.
- ord, Conn.
- rhill, Mass.-N. H.
- ley, Mass.-Vt.
- oke, Mass.-Conn.
- satonic, Mass.-N. Y.-
ɔnn.
- ne, N. H.-Vt.
- vrence.
- ıdonderry, Vt.
- well, Mass.-N. H.
- nchester, N. H.
- rlboro.
- arthas Vineyard.
- iddleboro.
- ilford, N. H.
- onadnock, N. H.
- oosup, Conn.-R. I.
- Iuskeget.
- Nantucket.
- Narragansett Bay, R. I.
- New Bedford.
- Newburyport.
- New London, Conn.-N. Y.
- Northampton.
- Norwich, Conn.
- Palmer, Mass.-Conn.
- Peterboro, N. H.
- Pittsfield, Mass.-N. Y.
- Plymouth.
- Providence, Mass.-R. I.
- Provincetown.
- Putnam, Conn.-R. I.
- Quinsigamond, Mass.-Conn.-R. I.
- Salem.
- Sandisfield, Conn.-Mass.
- Sheffield, Mass.-Conn.-N. Y.
- Springfield, Mass.-Conn.
- Stonington, Conn.-R. I.-N. Y.
- Taconic, N. Y.-Mass.-Vt.
- Taunton.
- Ware, Mass.-Conn.
- Warwick, Mass.-N. H.-Vt.
- Webster, Mass.-Conn.-R. I.
- Wellfleet.
- Wilmington, Vt.
- Winchendon, Mass.-N. H.
- Winnepesaukee, N. H.
- Winsted, Conn.
- Woodstock, Conn.
- Worcester.
- Yarmouth.

ı County; town of Chester; rises 2 miles northeast of Abbott
½ miles into West Branch of Westfield River (tributary
er to the Connecticut). Chesterfield sheet.

ystic River.

County; town of Plymouth; one of a group of small ponds
f the township west of Agawam River. Plymouth sheet.
h County; near village of Queen Anne Corners; outlet, Weir
ile long. Used as water supply for Hingham. Abington

tol County; rises one-half mile south of Little Quittacas
rd to the New Bedford Reservoir (not used), then southwest-
here it enters New Bedford Harbor on Buzzards Bay; length,
ıdleboro and New Bedford sheets.

in and Hampshire counties; rises in the town of Shutesbury;
uthwesterly to East village, where it unites with Amethyst
River (tributary to the Connecticut); length, 6 miles. Belcher-

kshire County; rises in Lake Agawam, in the southern part of
ridge; flows northeasterly 1½ miles into Konkapot Brook (tribu-
River). Pittsfield sheet.

Agawam Lake.—Berkshire County; southern part of the town of Stockbridge; ou Agawam Brook to Konkapot Brook (tributary to Housatonic River). Pittsf sheet.

Agawam River.—Plymouth County; rises in Halfway Pond in the town of I mouth; flows southwestward and westward and discharges into Wareham R. (tributary to Buzzards Bay) at Wareham; passes through several ponds; len about 10 miles. Plymouth sheet.

Alewife Brook.—Middlesex County; rises a short distance west of the city of C bridge; flows generally northward for about 2 miles into Mystic River; princi tributary, Little River, which drains Little and Spy ponds; connected by artifi channel with Fresh Pond, formerly part of the water system of Boston and vicin Boston sheet.

Allen Brook.—Franklin County; town of Shelburne; rises 2 miles northeast of village of Shelburne; flows southeastward 1½ miles, then eastward 1½ miles i Hinsdale Brook (tributary through Green River to Deerfield River and thu the Connecticut). Greenfield sheet.

Allens Pond.—Bristol County; town of Dartmouth; west of Slocums Neck; borde on south by tidal marsh; connected with Buzzards Bay by tidal channel. N Bedford and Fall River sheets.

Alum Pond.—Worcester County; 2 miles north of the village of Fiskdale; outle stream one-half mile long flowing southwestward into Long Pond (outlet Qui baug River and thus through Shetucket River to Thames River and Long Isl Sound); about three-fourths mile long and nearly half a mile wide. Brookfi sheet.

Ames Pond.—Norfolk and Bristol counties; towns of Stoughton and Easton; a l narrow pond at the head of Town River (tributary through Matfield River Taunton River and thus to Narragansett Bay). Dedham sheet.

Amethyst Brook.—Hampshire County; town of Pelham; head of Fort River (tri tary to Connecticut River). Belchertown sheet.

Andrews Pond.—Barnstable County; 1 mile north of Harwich village; on the edg a marsh which is drained by a stream flowing southwestward into Herring Ri (tributary to Nantucket Sound). Yarmouth sheet.

Annasnappet Brook.—Plymouth County; rises in the town of Plympton; flo south of west 2 miles into Wenatuxet River (tributary through Taunton Ri to Narragansett Bay. Middleboro sheet.

Anthony Creek.—Berkshire County; town of Adams; a stream 2 miles long, flow westerly into Tophet Brook (tributary through Hoosic River to the Hudson) j above its mouth. Greylock sheet.

Apponaganset River.—Bristol County; town of Dartmouth; an arm of South Da mouth Harbor; tidal; principal inflowing stream, Buttonwood Brook. N Bedford sheet.

Archers Pond.—Norfolk County; one-half mile west of Wrentham and about o fourth mile north of Whiting Pond. Franklin sheet.

Arm Brook.—Hampden County; rises east of East Farms, in the town of Westfi flows west of south 3½ miles into Powder Mill Brook (tributary through Westfi River to the Connecticut). Springfield sheet.

Artichoke River.—Essex County; rises 1½ miles southeast of West Newbury, at a tude 120 feet above sea level; flows slightly southeastward 1½ miles, passing arou the south slope of Indian Hill, then takes a general northerly course for 3 mi into Merrimack River about 2 miles west of Newburyport. Newburyport she

Ashby Reservoir.—About 2 miles southwest of Mill village; several inflow streams; outlet Willard Brook, which discharges through Ash Swamp to Squan cook River (tributary through Nashua River to the Merrimack); altitude feet above sea level. Fitchburg sheet.

; rises in Ashley Lake a mile northwest of the vil-
ıwestward 3½ miles into Sackett Brook (tributary
d for part of municipal supply of city of Pittsfield,

'ounty; rises on the north slope of Brace Mountain;
3 miles into Lee Pond Brook (tributary through
sen Kill and thus to the Hudson). Sheffield sheet.
y; town of Washington; one-half mile northwest of
utlet, Ashley Brook to Sackett Brook (tributary
part of municipal water supply of the city of Pitts-

y; town of Holyoke; 3 miles southwest of the city of
ock Pond; outlet, Black Brook to Westfield River
ıt); more than a mile long; about one-fourth mile

ınty; town of Peru; several inflowing streams; outlet
lowing southward into Housatonic Branch (tributary
dale). The lake is 1½ miles long and about one-fourth
. Becket sheet.
unty; town of Gill; rises on the north slope of Barnard
about a mile, then southeastward about a mile into
ick sheet.
County; 3 miles northeast of East Falmouth; about a
et.
ester County; rises in Asnebumskit Pond on the north
it Hill near Paxton Center at altitude 1,110 feet above
ularly northward and northeastward to its junction with
tary to Wachusett Reservoir); passes through several
all 480 feet. Worcester sheet.
ester County; north slope of Little Asnebumskit Hill;
ok, to Quinapoxet River (tributary to Wachusett Reser-
t above sea level. Worcester sheet.
er County; town of Hubbardston; 2 miles west of East
stream about a mile long flowing south of east into Ware
h Chicopee River to the Connecticut). Worcester sheet.
er and Middlesex counties; rises 1 mile south of Harvard at
sea level; flows southeastward 5 miles, then eastward 4
the south side of Spindle Hill and flowing into Assabet
gh Concord River to the Merrimack); fall 420 feet; passes
ponds. Marlboro and Framingham sheets.
Concord River. *See* Concord River.
ymouth County; town of Lakeville; principal inlets, stream
nasket River) and Bates Brook; outlet, Namasket River to
tary to Narragansett Bay); used by the city of Taunton as a
supply; about 2 miles long and 1½ miles wide. Immedi-
stern arm of the pond (Pocksha Pond) is Great Quitticas
ıtlet of which is Mattapoisett River; connection between
dicated by the map, but the water of Great Quitticas Pond
unicipal supply of New Bedford. Middleboro sheet.
ol and Plymouth counties; rises in the town of Lakeville;
thwestward into Taunton River (tributary to Narragansett
iles; principal tributaries, Cedar Swamp River and Quaker
al in lower course. Middleboro and Taunton sheets.

AVERIC LAKE.—Berkshire County; town of Stockbridge; one-half mile west of Cu
ville; natural outlet, a stream one-half mile long flowing southeastward into m
Brook (tributary to Housatonic River). Used as a source of water supply for
village of Stockbridge. Pittsfield sheet.

AVERY BROOK.—Franklin County; head of West Brook (tributary through Mill R
to the Connecticut). Northampton sheet.

AVERY BROOK.—Franklin County; rises near the village of Heath; flows southwa
miles into Deerfield River (tributary to the Connecticut) 1½ miles west of
Charlemont. Hawley sheet.

BABCOCK BROOK.—Worcester County; rises near Princeton Center, at altitude 1
feet above sea level; flows very irregularly eastward to its junction with
Wachusett Brook (tributary through Stillwater River to Wachusett Reserv
length, about 3 miles. Worcester sheet.

BABERY HILL BROOK.—Middlesex County; a stream about 1½ miles long flow
northeastward into Squannacook River (tributary through Nashua River to
Merrimack) at Townsend. Groton sheet.

BACHELDER BROOK.—Essex County; rises in a swamp about 3 miles northwest of
wich, at altitude 60 feet above sea level; flows northward 2½ miles into Mill R
(tributary through Parker River to Plum Island River, and thus to the Atla
Ocean); marshy throughout much of its course. Salem sheet.

BACHELOR BROOK.—Hampshire County; rises 3 miles northwest of Belchertown
small stream that flows into Upper Pond; passes southward through Middle
Lower ponds, southwestward to Forge Pond, thence in general westerly into
necticut River a mile northwest of South Hadley; receives many small tr
taries draining south slopes of the Holyoke Range. The only named tribu
is Elmer Brook. Belchertown and Northampton sheets.

BACK RIVER.—Barnstable County; town of Bourne; north of Monument Beac
tidal channel into Phinneys Harbor, Buzzards Bay. Falmouth sheet.

BACK RIVER.—*See* Duck Hill River.

BADDACOOK BROOK.—Middlesex County; rises in Baddacook Pond 2 miles north
of Groton at altitude 230 feet above sea level; flows southeastward 1 mile
Cow Pond on Cow Pond Brook (tributary through Massapoag ponds to Salm
Brook and thus to the Merrimack); fall, about 30 feet. Groton sheet.

BADDACOOK POND.—Middlesex County; 2 miles northeast of Groton; outlet, Baddac
Brook to Cow Pond on Cow Pond Brook (tributary through Massapoag pond
Salmon Brook and thus to the Merrimack); altitude, about 230 feet above
level. Groton sheet.

BAD LUCK BROOK.—Bristol County; town of Rehoboth; rises 2 miles southeast of G
Meadow Hill; flows southwestward to the reservoir east of Mount Terrydid
thence northwestward to Palmer River (head of Warren River), which is tr
tary to Narragansett Bay); length, about 6 miles. Taunton sheet.

BAD LUCK POND.—Worcester County; town of Douglas; west of East Douglas; an ex
sion of Mumford River (tributary to Blackstone River and thus through Seek
and Providence rivers to Narragansett Bay). Blackstone sheet.

BAD LUCK POND.—Worcester County; town of Douglas; 2 miles west of the villag
Douglas and one-half mile north of Wadkin Hill; outlet, a stream about a
long, flowing northward into Willis Pond Reservoir (outlet to Mumford River
thus through Blackstone River to Seekonk and Providence rivers and Narra
sett Bay). Webster sheet.

BAILEY BROOK.—Worcester County; a stream about 1 mile long, flowing from
north slope of White Hill northward into Wekepeke Brook (tributary thro
North Branch of Nashua River to Nashua River and thus to the Merrima
Worcester sheet.

ounty; rises on the south slope of Nineteenth Hill;
es into Otter River (tributary through Millers River
chendon sheet.

ounty; rises 2½ miles northwest of Framingham Center
above sea level; flows generally southeastward 2½ miles
as outlet by a small stream to Sudbury River (tributary
he Merrimack); fall about 140 feet. Framingham sheet.

unty; town of Gardner; rises one-half mile west of South
northward into a pond on Foster Brook (tributary to
ugh Millers River to the Connecticut); less than 2 miles

unty; rises about 4 miles north of the city of Fitchburg,
sea level; flows southeastward to its junction with North
(tributary through Nashua River to the Merrimack);
tributaries, Scott Brook and Pearl Hill Brook. Fitch-

unty; town of Brimfield; a small pond discharging by a
ward into Long Pond (outlet to Quinebaug River and
iver to Thames River and Long Island Sound). Brook-

County; town of Dennis; 2 miles south of East Dennis.

County; town of Orleans; 2 miles southwest of village of
t.

ounty; one-half mile northeast of South Georgetown, at
ea level; inlets, two small streams from the north; outlet
arker River (tributary through Plum Island River to the
n sheet.

x County; in a swamp about one-fourth mile east of Sud-
orthwest of Wayland; outlet, a small stream to Sudbury
h Concord River to the Merrimack); very small. Fram-

sex County; a stream about a mile long, flowing south-
ook (tributary through Nashua River to the Merrimack).

sex County; one-half mile southwest of Harvard; inlet,
by Bowers Brook to Nonacoicus Brook and thus through
errimack; altitude about 330 feet above sea level; a large
r outline, about 1 mile long and one-half mile in maximum
.

uth County; rises one-half mile northwest of Pine Hill;
iles into Jones River Brook (tributary through Jones River
nch of Massachusetts Bay). Middleboro sheet.

sex County; a very small pond 1½ miles southwest of Salem
t of Lynn; altitude 100 feet above sea level; outlet, a small
l, which is 1½ miles from Wenuchus Lake (tributary to a
hat forms part of the drainage system of the city of Lynn).

shire County; town of Plainfield; a stream about 2 miles
rd into Westfield River (tributary to the Connecticut) a
mmington. Hawley and Chesterfield sheets.

uth County; town of Plymouth; northwest of Manomet
the ocean by a sand bar. Plymouth sheet.

Bartlett Pond.—Worcester County; 1 mile east of Northboro; inlet, Stirrup Br from Little Chauncey Pond; outlet, Stirrup Brook to Assabet River (tribu through Concord River to the Merrimack; altitude about 440 feet. Marl sheet.

Bartletts Brook.—Hillsboro County, N. H., Essex County, Mass.; rises in town of Pelham in Hillsboro County, N. H., one-half mile northwest of the Ma chusetts-New Hampshire boundary, at altitude about 185 feet above sea le flows southeastward 2 miles, then north of east 2 miles into Merrimack Ri about 2 miles west of Lawrence, Mass.; principal tributary, a small stream fr Peters Pond. Lowell and Lawrence sheets.

Bartletts Brook.—Plymouth County; rises in Meeting House Swamp in the to of Middleboro; flows west of north along the western edge of Great Cedar Swam into Wenatuxet River (tributary through Taunton River to Narragansett Ba length, about 4 miles; principal tributary, Dansons Brook. Middleboro she

Bashbish Brook.—Berkshire County, Mass., Columbia County, N. Y.; formed the town of Mount Washington by the union of Guilder and City brooks. Ci Brook, draining the larger area, rises between Mount Everett and Race Mounta and flows north of west to the junction with Guilder Brook. From this poi Bashbish Brook flows northwestward to Copake Ironworks and thence sou westerly to its junction with Rocliff Jansen Kill (tributary to the Hudson); len east of the Massachusetts-New York boundary line (to head of City Brook) ab 5 miles; principal tributaries in this area, Wright and Lee Pond brooks. Sh field and Copake sheets.

Basin Brook.—Franklin County; rises near South Hawley; flows northwestwa 2½ miles into King Brook (tributary through Chickley River to Deerfield Ri and thus to the Connecticut). Hawley sheet.

Basin Pond.—Berkshire County; a mile west of Becket Mountain, in the east part of the town of Lee. The map shows two natural outlets—one from the w end (Basin Branch), the other from the southeast corner; both outflowing strea discharge naturally to the brook connecting Greenwater Pond with Housato River at Lee. The water of these streams is used as a municipal water sup for the village of Lee. Becket sheet.

Bass Creek.—Barnstable County; a tidal channel in the marsh north of Barnsta Harbor. Barnstable sheet.

Bass Creek.—Barnstable County; town of Sandwich; a tidal channel in the ma back of Scusset Beach. Plymouth sheet.

Bassett Brook.—Berkshire County; rises 1½ miles southwest of Mount Greylo flows southeastward 3 miles into Hoosic River (tributary to the Hudson) Cheshire Harbor. Greylock sheet.

Bassett Brook.—Plymouth County; rises in the southern part of the town of Du bury; flows southward 1½ miles into Hall Brook (tributary through Jones Ri to Kingston Bay, a branch of Massachusetts Bay). Duxbury sheet.

Bass Pond.—Hampden County; a small pond 3 miles east of Springfield; betwe two forks of the south branch of Mill River (tributary to the Connecticut). Sprin field sheet.

Bass Reservoir.—Franklin County; town of Warwick; west of Mount Grace; Mill Brook (tributary to Connecticut River). Warwick sheet.

Bass River.—Barnstable County; rises northwest of Germans Hill, 1½ miles sout east of village of Yarmouth; flows northeastward into Mill Pond, eastward Follins Pond, southeastward to South Dennis, thence southwestward into Na tucket Sound; tidal below Follins Pond; length to extreme head, 8 miles. Y mouth sheet.

Bass River.—Essex County; rises about 2 miles east of Danvers; flows somewh southeastward 2 miles into an arm of Beverly Harbor at Beverly. Salem she unty; a tidal channel on the north side of Green Harbor

County; a very small pond 2 miles south of Carlisle,
t above sea level; outlet, a stream flowing into Spencer
n Assabet River to Concord River and thus to the Mer-
sheet.

County; rises in the swamp near Haskins station; flows
ard into Assawompsett Pond (outlet through Namasket
and thus to Narragansett Bay) northwest of Green Point;
ddleboro sheet.

len County; a stream 1½ miles long flowing southwest-
ver (tributary to the Connecticut) one-half mile north of
. Granville sheet.

heshire County, N. H., Worcester County, Mass.; rises in
of the town of Rindge; flows southwestward 2½ miles, then
mile to its junction with Bluefield Brook to form Millers
Connecticut). Fitchburg sheet.

ssex County; rises in a very small pond one-half mile north-
Hill and about 1½ miles north of Lawrence; flows generally
into Hawkes Brook (tributary to Merrimack River). Law-
heets.

Middlesex County; rises about a mile north of Reading, at
sea level; flows generally east of north 2 miles into Ipswich
eet.

County; rises 1½ miles east of Buckland Four Corners; flows
, then easterly and northeasterly 4 miles to its junction with
utary to the Connecticut); tributary, Pea Brook. Hawley
s.

County; rises one-half mile south of West Newbury, at alti-
bove sea level; flows southeastward 3 miles through a swamp
Parker River (tributary to Plum Island River, and thus
n) 1 mile west of Byfield. Newburyport sheet.

County; rises about 1½ miles west of Danvers, at altitude 120
; flows southeastward one-half mile, northeastward 1 mile to
er Brook, then generally southeastward 2 miles to its junc-
rook to form Crane River (a tidewater channel tributary to
hus to the Atlantic Ocean at Beverly Harbor) at Danvers; fall
tion with Crane Brook, 80 feet; marshy throughout much of its
et.

klin and Hampshire counties; rises in the southwestern part
tely; flows southeastward 2 miles, thence southwesterly 3 miles
ributary to the Connecticut) at Leeds. Northampton sheet.

npshire County; town of Ware; rises one-half mile north of Mor-
uthward 5 miles into Ware River (tributary through Chicopee
necticut) west of Gibbs Crossing. Belchertown and Palmer

lsboro County, N. H., Middlesex County, Mass.; rises in the town
, about 3½ miles north of the head of Beaver Lake, at altitude
ove sea level; takes a general southwesterly course for about 12
towns of Derry and Londonderry, to Hudson, N. H., southeast-
elham, N. H., southwestward again 4 miles to Collinsville, Mass.,
rd 3 miles into the Merrimack. The greater part of the drainage
Hampshire. In Massachusetts its principal tributary is Double
ster and Lowell sheets.

Beaver Brook.—Middlesex County; rises about 2 miles south of Lexington, flows general southward to junction with Clematis Brook near Waltham, then east ar south into Charles River at Waltham; passes through Hardys Pond. Boston shee

Beaver Brook.—Middlesex County; rises near the south slope of Chestnut Hi 2 miles west of Chelmsford Center, at altitude 280 feet above sea level; flo generally southward 1½ miles, then takes an irregular course northeastward 4 mil into River Meadow Brook (tributary through Concord River to the Merrimac one-half mile east of Chelmsford Center; it passes through a small pond at Chelm ford Center. Lowell sheet.

Beaver Brook.—Middlesex County; rises 1 mile south of Boxboro, at altitude abo 330 feet above sea level; takes a general northeasterly course through Mill Po to Forge Pond (outlet through Stony Brook to Merrimack River); marshy in low part of its course. Marlboro, Groton, and Lowell sheets. *See also* Stony Broo

Beaver Brook.—Plymouth County; rises in the town of Holbrook; flows southwa to a point near East Bridgewater, where it unites with Salisbury Plain River form Matfield River (tributary through Taunton River to Narragansett Bay length, 8 miles; passes through a number of small ponds. Abington sheet.

Beaver Brook.—Plymouth County; town of Bridgewater; a stream about a mile lo flowing west of south into Spring Brook (tributary through Taunton River Narragansett Bay). Middleboro sheet.

Beaver Brook.—Worcester County; rises on the southwest slope of Winter Hi flows east of south 4 miles, thence southwestward into one of the reservoirs abo Curtis Pond (outlet, Blackstone River to Seekonk River and thus through Prov dence River to Narragansett Bay). Worcester sheet.

Beaver Brook.—Worcester County; town of Phillipston; flows northward in Millers River (tributary to Connecticut River) at South Royalston; length, miles. Winchendon sheet.

Beaver Brook.—Worcester County; town of Royalston; rises 1 mile north of Sout Royalston; flows northeastward 2½ miles, then northwestward 3 miles into a pon on Lawrence Brook (tributary through East Branch of Tully River to Tully Riv and thus through Millers River to the Connecticut). Winchendon sheet.

Beaver Creek.—Bennington County, Vt., Berkshire County, Mass.; rises in th southern part of the town of Stamford, Vt.; flows southeasterly 2 miles into Clark burg, Mass., then northeasterly 1½ miles into the North Branch of Hoosic Riv (tributary through Hoosic River to the Hudson). Greylock sheet.

Beaver Dam Brook.—Essex County; rises 3 miles northeast of Wakefield, at altitud 80 feet above sea level; flows generally west of south 2½ miles into Saugus Rive which discharges into Boston Bay. Lawrence sheet.

Beaver Dam Brook.—Plymouth County; rises 2 miles northwest of the village Carver; flows southwestward 2 miles, then east of south 1½ miles into Weweant River (tributary to Buzzards Bay). Middleboro sheet.

Beaver Dam Pond.—Plymouth County; town of Plymouth; a large pond of very irr gular outline lying a mile or more back from the beach near the village of Manome outlet to Bartlett Pond. Plymouth sheet.

Beaver Dam Pond.—Plymouth County; town of Wareham; a small pond 1 mile nort west of Onset. Plymouth sheet.

Beaver Pond.—Essex County; 4½ miles west of Manchester; inlet, a small marsh stream coming in from the north; outlet, a small stream to Miles River (tributar to Ipswich River); length, 1 mile; very narrow. Salem sheet.

Beaver Pond.—Middlesex County; three-fourths mile south of Lincoln; one inflo ing stream; outlet, a stream about a mile long flowing southward into Stony Broo (tributary to Charles River). Framingham sheet.

inty; one inlet; outlet, a stream 1½ miles long flowing
River (tributary to Boston Bay); altitude about 225 feet

inty; 1 mile west of Franklin; inlet, Mine Brook; outlet,
iver (tributary to Boston Bay). Franklin sheet.

; 3 miles northwest of Manchester; outlet, a small stream
has outlet by another small stream to Chebacco Lake and
bout one-half mile long; maximum width, less than one-
) feet above sea level. Salem sheet.

n County; town of Blandford; rises on the west slope of
south 2½ miles into Pebble Brook and thus to Springfield
Little River. *See* Granville sheet.

County; rises in the town of Oakham; flows northwest-
Plains, where it unites with Burrow Brook to form Pratt
gh Ware River to Chicopee River and thus to the Con-
t.

in County; rises just south of the Vermont-Massachusetts
rthfield; flows southeasterly to its junction with Connecti-
e east of Mount Hermon; length, 5 miles. Warwick sheet.

esex County; rises 2 miles northeast of Harvard Village;
iles, then northeastward 3½ miles into Forge Pond (through
o Stony Brook and thus to the Merrimack); passes through
ton sheet.

re County; town of Washington; about a mile east of Wash-
t, Coles Brook to West Branch of Westfield River (tributary
ver to the Connecticut). Becket sheet.

uth County; 2½ miles east of South Middleboro; outlet, a
f mile long, flowing eastward to Weweantic River (tributary
Middleboro sheet.

ire County; town of Otis; a mile north of East Otis; principal
ite Lily Pond; outlet to Otis Reservoir, which is used to regu-
mington River (tributary to the Connecticut); about a mile
ile wide. Sandisfield sheet.

re County; southeastern part of the town of Hancock; outlet,
Brook to Wyomanock Creek (tributary through Kinderhook
n). Berlin sheet.

n County; rises on the east slope of Wilbraham Mountains, in
ham; flows southerly 4 miles to Hampden, where it enters
butary through Scantic River to the Connecticut). Palmer

rcester County; rises in the town of Phillipston on the north
ill; flows southeastward 2½ miles into the East Branch of Swift
hrough Swift River to Ware River and thus through Chicopee
ecticut). Winchendon sheet.

arnstable County; town of Yarmouth; 1½ miles north of West
outh sheet.

ex County; 2 miles northeast of Wakefield; inlet, a stream 1
in from the north; outlet, a small stream flowing into Saugus
charges into Boston Bay; altitude, 100 feet above sea level;
-half mile; maximum width, about one-fourth mile. Lawrence

rfolk County; town of Sharon; outlet, Rumford River to Three-
utary through Taunton River to Narragansett Bay). Dedham

Billington Sea.—Plymouth County; town of Plymouth; a lake more than a mi long and one-half mile wide; outlet through Town Brook to Plymouth Harb inlet from Little Pond. Plymouth sheet.

Birch Brook.—Berkshire County; head of Buxton Brook (tributary through He lock Brook to Hoosic River and thus to the Hudson). Berlin and Greylo sheets.

Birch Brook.—Bristol County; rises near North Rehoboth; flows northeastward miles into Threemile River (tributary through Taunton River to Narraganse Bay); principal tributary, Meadow Brook. Taunton sheet.

Birch Pond.—Essex County; 1 mile northwest of Lynn; inlet, small strea unnamed on the map; outlet, stream to Revere Brook (tributary to Saugus Riv which discharges into Boston Bay); altitude, 80 feet above sea level; length, abo 1 mile; maximum width, less than one-fourth mile. Boston and Boston B sheets.

Bixby Reservoir.—Middlesex County; 2 miles west of south from Townsend; n ural outlet, a stream 2 miles long flowing northeastward into Harbor Pond Squannacook River (tributary through Nashua River to the Merrimack). Grot sheet.

Black Betty Brook.—*See* West Meadow Brook.

Black Brook.—Bristol County; town of Easton; rises about 1½ miles southwest North Easton; flows southeasterly into Great Cedar Swamp, the drainage of whi passes through Town River to Matfield River and thus through Taunton Riv to Narragansett Bay; length, about 6 miles, about 3 miles of its course being the swamp. Dedham and Taunton sheets.

Black Brook.—Essex County; rises 4 miles southwest of Ipswich; flows somewh northwestward for about 3 miles into Ipswich River; passes through Cutlet Po near its source; marshy throughout much of its course. Salem sheet.

Black Brook.—Hampden County; rises about 3 miles north of Blandford; flo southeastward 5 miles to Russell, where it enters Westfield River (tributary the Connecticut); principal tributary, Freeland Brook. Granville sheet.

Black Brook.—Hampden County; rises on Sheldon Hill, in the town of Holyo flows southwestward through Hitchcock and Ashley ponds and joins Westfie River (tributary to the Connecticut) near Tatum in the town of West Springfie length, 7½ miles. Springfield sheet.

Black Brook.—Middlesex County; rises one-half mile east of Lower Massap Pond, at altitude 200 feet above sea level; flows northwest and west into Salm Brook (tributary to the Merrimack near Dunstable); length, about 2 mil Lowell sheet.

Black Brook.—Plymouth County; rises 1 mile northwest of South Middlebo flows west of south 5 miles, then westward one-half mile into Great Quitta Pond, the natural outlet of which is Mattapoisett River; principal tributa Millers Neck Brook. Middleboro sheet.

Black Brook.—Plymouth County; rises near Northville, about 1½ miles south Whitman; flows southward 3 miles into Satucket River (tributary through Ma field River to Taunton River and thus to Narragansett Bay). Abington sheet.

Blackfish Creek.—Barnstable County; town of Wellfleet; a tidal channel exten ing from South Wellfleet into Wellfleet Harbor. Wellfleet sheet.

Blackmore Pond.—Plymouth County; a mile south of South Wareham; outlet, stream 1 mile long flowing southwestward into Hammond Brook (tributa through Weweantic River to Buzzards Bay). Middleboro sheet.

Black Point Pond.—Dukes County; Marthas Vineyard; Chilmark; between Chi mark Pond and Tisbury Great Pond; one of the group of connected ponds o the southern border of the island separated from the Ocean by a continuo barrier beach. Marthas Vineyard sheet.

County; 2½ miles northwest of West Granville; outlet,
y to Springfield reservoir on Westfield Little River, p. 424.

County; 1 mile north of the village of Boxboro; one-fourth
ook. Groton sheet.

County; town of Norwell; at southern edge of Black Pond
l Herring Brook to North River. Abington sheet.

County; town of Plymouth; 2 miles west of Lookout Point;
h sheet.

County; a very small pond 4 miles southeast of East Dou-
et.

sex County; a tidal stream beginning 1½ miles east of East
ng a very irregular course southward into Merrimack River
2½ miles; marshy. Newburyport sheet.

County; a stream about 3 miles long rising in the town of
neral north of east, and discharging into Quincy Bay. Bos-

Vorcester County, Mass., and Providence County, R. I.;
of Worcester by the union of several brooks. Kettle Brook,
ger area, and is therefore considered the continuation of the
est slope of Little Asnebumskit Hill and flows southeastward
ce eastward and northward to its junction with Blackstone
western part of the city of Worcester; from its junction the
utheastward to Seekonk River and thus through Providence
ett Bay; length to head of Kettle Brook, about 45 miles; the
es in Massachusetts below Kettle Brook are Singleton Brook
, Mumford, West, and Mill rivers. The basin contains no
Lake Quinsigamond, but small ponds and reservoirs used
nerous; its flow is thus fairly constant and its powers are very
rage rainfall on the basin about 45 inches. Gaging stations:
at Woonsocket, R. I., 1904–5; Blackstone River at Berkeley,
ckstone River at Albion, R. I., 1915. Worcester, Marlboro,
kstone sheets.

–Plymouth County; town of Kingston; principal inlet, Halls
alls Brook to Jones River (tributary through Kingston Bay to
y). Duxbury sheet.

den County; town of Blandford; one inflowing stream; outlet, a
mile long flowing southeastward into Pond Brook (tributary
Brook to Springfield reservoir on Westfield Little River, p. 424).

nouth County; town of Rehoboth; rises about 3 miles southwest
oth; flows southward 5 miles into Palmer River (the head of
tributary to Narragansett Bay); tributary, Wolf Plain Brook.
t.

ampden County; rises in West Springfield; flows southerly 2½
field River (tributary to the Connecticut). Springfield sheet.

OOK.—Worcester and Hampden counties; rises (as Tufts Brook)
st of West Warren; flows southwestward 1½ miles, northwestward
westward and southwestward 2½ miles into Quaboag River (tribu-
Chicopee River to the Connecticut); principal tributary, Taylor
field and Palmer sheets.

rcester County; town of Dudley; 2½ miles northeast of West Dud-
stream about 3 miles long flowing southwestward into Quinebaug
ry through Shetucket River to Thames River and thus to Long
. Webster sheet.

Bloody Brook.—Essex County; rises about a mile north of Lawrence, just southwest of Powder House Hill, at altitude about 130 feet above sea level; flows southeastward 1½ miles into Spickett River (tributary to the Merrimack at Lawrence; fall from source to mouth, about 70 feet. Lawrence sheet.

Bloody Brook.—Franklin County; town of Deerfield; rises on the northwest slope of North Sugarloaf; flows southwesterly into Mill River (tributary to the Connecticut) 1½ miles west of South Deerfield; length, 3 miles. Northampton sheet.

Bloody Pond.—Plymouth County, town of Plymouth; east-central part of the township; one-half mile long. Plymouth sheet.

Bluefield Brook.—Worcester County. *See* Millers River.

Boat Meadow River.—Barnstable County; a channel in the marsh, three-fourths mile north of Rock Harbor. Wellfleet sheet.

Bogastow Brook.—Middlesex and Norfolk counties; rises on the northwest slope of Long Hill, about 3 miles northwest of Holliston, at altitude 250 feet above sea level; takes a very irregular but in general southeasterly course to its junction with Charles River 2 miles northwest of Medfield, in Norfolk County; length, about 10 miles; many small tributaries unnamed on the map. Franklin sheet.

Boon Pond.—Middlesex County; 3 miles east of Hudson and just southwest of Boon Hill; altitude about 200 feet above sea level; inlet, a stream about one-half mile long and marshy; outlet, a very small stream flowing northwestward into Assabet River (tributary through Concord River to the Merrimack); length, 1 mile; maximum width, one-fourth mile. Marlboro and Framingham sheets.

Boot Pond.—Plymouth County; town of Plymouth; southeast of Great South Pond, from which it is separated by a narrow ridge. Plymouth sheet.

Borden Brook.—Hampden County; rises in Black Pond, 2½ miles northwest of West Granville; flows northeasterly and easterly 4½ miles to Russell, where it joins Pebble Brook (tributary to Springfield Reservoir on Westfield River, p. 424). Granville sheet.

Boston Brook.—Essex County; rises in a swamp about a mile southeast of Andover on the west slope of Holts or Prospect Hill, at altitude 260 feet above sea level; flows north of east 3 miles, northward about a mile, and then takes a very irregular course southeastward for 5½ miles into Ipswich River; marshy throughout most of its course; fall from source to mouth, about 200 feet. Lawrence and Salem sheets.

Bottomless Pond.—Middlesex County; 2 miles south of Maynard; one-half mile southwest of Willis Pond, at the head of Run Brook (tributary through Hop Brook to Wash Brook and thus through Sudbury and Concord River to the Merrimack; altitude about 200 feet above sea level; very small. Framingham sheet.

Bottomless Pond.—Middlesex County; a very small pond 2½ miles south of Maynard, 2 miles southeast of Assabet River (tributary through Concord River to the Merrimack; altitude, 200 feet above sea level. Framingham sheet.

Bottomly Pond.—Worcester County; town of Paxton; 1 mile west of Asnebumskit Hill near the head of Kettle Brook, which is its natural outlet to Blackstone River (tributary through Seekonk and Providence rivers to Narragansett Bay); used as a part of the water supply system of Worcester. Worcester sheet.

Bound Brook.—Plymouth and Norfolk counties; rises in Norfolk County one-half mile northwest of Otis Hill, in the town of Norwell; flows northward and northeastward and discharges into the ocean through Cohasset Harbor; length from Cohasset Cove to head, about 6 miles. Abington sheet.

Bow Brook.—Middlesex County; rises in Turner Pond in Worcester County, at altitude about 310 feet above sea level; flows northeastward 2 miles into a stream connecting Shirley Reservoir with Nashua River (tributary to the Merrimack); marshy. Groton sheet.

Bowens Pond.—Barnstable County; town of Falmouth; a pondlike bay connected with Vineyard Sound by a narrow channel. Falmouth sheet.

re County; a stream a mile long flowing northwestward
ry to the Hudson) 2 miles south of North Adams. Grey-

County; rises on Vaughn Hill at altitude about 500 feet
rtheastward through Bare Hill Pond, then irregularly
south of Ayer through which it discharges to Nonacoicus
Nashua River to the Merrimack; length, about 8 miles;
Spring Brook; marshy through much of its course below
oro and Groton sheets.

unty, N. H., Worcester County, Mass.; rises in the town
south of Little Monadnock Mountain; flows southward 6
Branch of Tully River (tributary through Tully River to
to the Connecticut) in Long Pond, in the town of Royal-
et.

County; town of Hawley; rises 2 miles northwest of the
s northward 3 miles into Deerfield River (tributary to the
Charlemont. Hawley sheet.

klin and Hampshire counties; rises in the town of Conway;
miles into the East Branch of Mill River (tributary through
necticut). Chesterfield and Northampton sheets.

th County; town of Marshfield; a tidal estuary in the lower
. Duxbury sheet.

er County, Mass., and Providence County, R. I.; rises in
he western boundary of Rhode Island; flows easterly and
several small ponds and enters Blackstone River (tributary
d thus through Providence River to Narragansett Bay) near
ceives drainage from other ponds and swamps. Gaging station
R. I., 1909–1913. Webster, Blackstone, and Burrillville

OOK.—Bristol County; rises about 1½ miles east of Watuppa
outh 4½ miles to its junction with the East Branch of Westport
the ocean through Westport Harbor). Fall River sheet.

Vorcester County; rises in the northeastern part of the town of
County, Conn., in Great Neck Pond; flows northeastward 4½
aug River (tributary to Shetucket River and thus through
ong Island Sound). Brookfield sheet.

County; on the northwest outskirts of Lynn; outlet, Revere
ver, which discharges into Boston Bay. Boston Bay sheet.

table County; town of Harwich; 1 mile south of Long Pond.

dlesex County; rises on the north slope of Pendleton Hill, one-
t of Sudbury Center, at altitude about 160 feet above sea level;
rth of east 2 miles into Sudbury River (tributary through Con-
Merrimack); swampy throughout its course. Framingham sheet.

nstable County; a tidal channel in the Great Marshes west of
r. Barnstable sheet.

OOK.—Middlesex County; rises on the north slope of Oak Hill,
Lowell, at altitude 200 feet above sea level; flows in general east
nction with Merrimack River at Tyngsborough; length, 4 miles.

nstable County; town of Harwich; 1½ miles south of Long Pond.
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Brigham Pond.—Worcester County; town of Hubbardston; on the west branc Ware River (tributary through Ware River to Chicopee River and thus to Connecticut). Worcester sheet.

Broad Brook.—Bennington County, Vt., Berkshire County, Mass.; rises in eastern part of the town of Pownal; flows southwestward 7 miles to the north part of Williamstown, Mass., where it enters Hoosic River (tributary to the H son); length in Massachusetts, 2 miles. Greylock sheet.

Broad Brook.—Hampshire County; rises 1 mile southeast of Haydenville; fl southward 1 mile, then turns through the southeast to a northeast and northe course and unites with Running Gutter Brook (tributary through Mill Rive the Connecticut) west of West Hatfield; length, about 4 miles. Northamp sheet.

Broad Brook.—Hampshire and Hampden counties; rises 1½ miles southwest Belchertown; flows southward into Chicopee River (tributary to the Connectic 2 miles west of Three Rivers; length, 6 miles, principal tributary, stream f Springfield reservoir. Belchertown and Palmer sheets.

Broad Creek.—Nantucket County; Nantucket Island; one of a series of tidal in at the western end of the island. Muskeget sheet.

Broad Creek.—Plymouth County; town of Marshfield; a tidal estuary in the lo course of North River. Duxbury sheet.

Broad Marsh River.—Plymouth County; town of Wareham; connects w Wareham River (tributary to Buzzards Bay) between Wareham Neck Swifts Neck; tidal. Plymouth and Falmouth sheets.

Broad Meadow Brook.—Worcester County. *See* Dorothy Brook.

Brockton Reservoir.—Norfolk County; town of Avon; 3 miles northwest of Bro ton; inlet from a swamp on the north; natural outlet, Saulsbury Brook to Salisb Plain River and thus through Matfield River to Taunton River and Narragan Bay; called also Saulsbury Brook reservoir. Dedham sheet.

Bronson Brook.—Hampshire County; head of West Branch (tributary thro Westfield River to the Connecticut). Chesterfield sheet.

Brooks Pond.—Worcester County; 3 miles northeast of North Brookfield on Fi mile River (tributary through East Brookfield River to Quaboag River and t through Chicopee River to the Connecticut); 1½ miles long; nearly one-half m in maximum width. Barre sheet.

Brown Pond.—Essex County; about 1½ miles north of the city of Lynn and o half mile from Wenuchus Lake; inlet, a small stream from the north draining B tholomew Pond; length, about one-half mile; maximum width, about fourth mile; altitude about 100 feet above sea level. Salem and Boston B sheets.

Brown Pond.—Worcester County; town of Phillipston; an expansion of Burnsh River (tributary through Ware River to Chicopee River and thus to the Conne cut). Winchendon sheet.

Browns Brook.—Worcester County; town of Webster; a stream about 1 mile l flowing southwestward into Lake Chaubunagungamaug (outlet Mill Broo French River and thus through Quinebaug River to Shetucket River, Tha River, and Long Island Sound). Webster sheet.

Buckman Brook.—Worcester County; town of Athol; a stream about 2 miles l flowing northward into Millers River (tributary to Connecticut River) 1½ m southwest of South Royalton. Winchendon sheet.

Buckmaster Pond.—Norfolk County; southwestern part of town of Dedham; let, Hawes Brook to Neponset River. Dedham sheet.

Buck River.—Berkshire County; rises south of Morley Hill; flows southeastw through the town of Sandisfield to West New Boston, where it joins Clam Ri (tributary through Farmington River to the Connecticut); length, 6 mi Sandisfield sheet.

nty; towns of Monterey and New Marlboro; outlet, a
g flowing southeastward into Konkapot River (tributary
Hartsville. The lake is 1½ miles long and about one-
eld sheet.

; rises in a swamp northwest of Bartholomew Hill and
t altitude 60 feet above sea level; flows northeastward 4
Muddy Run; tributary to Rowley River, a tide water
d River (separated from the Atlantic Ocean by Plum
ns mile east of Rowley; marshy; Salem sheet.

r County; rises about 3 miles southeast of Shrewsbury;
niles into a pond on Hop Brook (tributary through Assa-
ver and thus to the Merrimack). Marlboro sheet.

er County; town of Shrewsbury; rises just south of the
flows southward to North Grafton, where it enters Quin-
ary to Blackstone River and thus through Seekonk and
arragansett Bay); length, 5 miles. Marlboro and Black-

County; town of Plymouth; one of a group of small ponds
t of the township. Plymouth sheet.

istol County; on line between towns of Mansfield and
et, Bungay River to Tenmile River (tributary through
ovidence River and thus to Narragansett Bay). Franklin
s.

County; rises in Bungay Reservoir in the town of North
hward to Attleboro, thence northwestward to Tenmile River
ekonk River to Providence River and thus to Narragansett
5 miles. Providence sheet.

esex County; at East Woburn; about three-fourths mile west
Aberjona River; outlet, Aberjona River to Mystic lakes and
c River to Boston Bay; small. Boston sheet.

lesex County; one-half mile northwest of Westford station,
oad; outlet, a stream one-eighth mile long flowing eastward
(tributary through Stony Brook to the Merrimack). Lowell

orcester County; rises about a mile northeast of Spencer; flows
ugh Burncoat Pond to Cedar Meadow Pond, thence eastward
Brook, the head of French River (tributary through Quinebaug
t River and thus through Thames River to Long Island Sound).

orcester County; about half way between Spencer and Leicester;
Brook through Cedar Pond to Town Meadow Brook, the head of
ibutary through Quinebaug River to Shetucket River and thus
River to Long Island Sound). Webster sheet.

anklin County; town of Chesterfield; several small inflowing
Dead Branch to East Branch (tributary through Westfield River
ut); 1 mile long and one-eighth mile wide. Chesterfield sheet.

-Worcester County; rises in the town of Phillipston; flows north
, then southeastward 10 miles into Ware River (tributary through
to the Connecticut) 1½ miles below Barre Falls; passes through
rincipal tributaries, a stream from Phillipston Pond, which enters
t East Phillipston, Wine Brook, and Canesto Brook. Gaging sta-
pleton (1909). Winchendon and Barre sheets.

-Worcester County. *See* Pratt Brook.

Burt Pond.—Worcester County; town of Sutton; inlet and outlet, Purgatory Broo which flows through the pond to Whitins Pond on Mumford River (tributary Blackstone River and thus through Seekonk and Providence rivers to Narraga sett Bay). Blackstone sheet.

Buttonwood Brook.—Bristol County; rises a mile northwest of the city of Ne Bedford; flows southward about 4 miles into Apponaganset River (an arm South Dartmouth Harbor). New Bedford sheet.

Buxton Brook.—Berkshire County; rises (as Birch Brook) in the extreme nort western part of the town of Williamstown; flows southeastward 3½ miles to the ci of Williamstown, where it enters Hemlock Brook (tributary through Hoosic Riv to the Hudson). Berlin and Greylock sheets.

Cadwell Creek.—Hampshire County; town of Enfield; rises near Packardsvill flows southeastward 2½ miles into the West Branch of Swift River (tributa through Swift River to Ware River and thus through Chicopee River to the Co necticut). Belchertown sheet.

Cady Brook.—Worcester County; town of Charlton; rises on the north slope of Cur Hill; flows southward through Hicks Pond to Charlton City, thence southwe ward to its junction with Quinebaug River (tributary through Shetucket River Thames River and thus to Long Island Sound) at the city of Southbridge; leng about 8 miles. Webster and Brookfield sheets.

Caleb Pond.—Dukes County; Chappaquiddick Island, east of Marthas Vineyard; tidal pond connected with the channel between the two islands. Marthas Vin yard sheet.

Calkins Pond.—Hampden County; 1 mile southeast of Palmer Center; outlet, stream 2½ miles long flowing northward through Forest Pond Into Ware Riv (tributary through Chicopee River to the Connecticut); small. Palmer sheet.

Canesto Brook.—Worcester County; rises in the northwestern part of the town Hubbardston; flows southeastward 5 miles, then southward and southwestwa 1½ miles into Burnshirt River (tributary through Ware River to Chicopee Riv and thus to the Connecticut); principal tributary, Natty Pond Brook. Winche don and Barre sheets.

Canoe River. *See* Mill River, Bristol County.

Canton River.—Norfolk County; rises in Massapoag Pond, in the town of Sharo flows east of north to Canton, and then northwestward into Neponset River on half mile below the mouth of Traphole Brook; passes through several small pon and the large pond at Canton which receives also a stream from Reservoir Po and one which drains the central part of the town of Stoughton; length of princip branch from Neponset River to Massapoag Pond, about 6 miles; fall between t reservoir and Canton, about 170 feet. Dedham sheet.

Cape Pond.—Essex County; 1½ miles northeast of Gloucester and 1 mile southwest Rockport; length, about one-half mile; maximum width, about one-eighth mil Gloucester sheet.

Carpenters Brook.—Bristol County; town of Rehoboth; rises one-half mile southea of Great Rock; flows southeastward into Palmer River (tributary through Warr River to Narragansett Bay) near the village of Rehoboth; length, 2 miles. Prov dence sheet.

Caruth Brook.—Worcester County; rises one-half mile west of Turkey Hill Pon flows southwesterly 3 miles into Turkey Hill Brook (tributary through Sevenmi River to East Brookfield River and thus through Quaboag River to Chicop River and the Connecticut). Worcester sheet.

Castle Neck River.—Essex County; rises 2 miles southeast of Ipswich and takes very irregular course northeastward for 6 miles into the Atlantic Ocean west Castle Neck; terminates in a tidewater channel; swampy throughout its cours Salem sheet.

orcester County; rises near Lunenburg at altitude about
; flows southeastward about 4 miles and discharges into a
nnected by a very short stream with Shirley Reservoir
ua River to the Merrimack); principal tributaries, streams
nd Massapoag ponds; fall from head to Shirley Reservoir,

County; town of Plymouth; one-half mile southwest of
uth sheet.
Vorcester County; 1½ miles southwest of the village of
Burncoat Pond; outlet, Burncoat Brook to Town Meadow
River, which is tributary through Quinebaug River to
us through Thames River to Long Island Sound). Webster

County; town of Dennis; 1 mile south of East Dennis;

e County; 1 mile northwest of North Falmouth; outlet, a
vestward into Cataunet Harbor, Buzzards Bay. Falmouth

nty; 3 miles west of Peabody; 4 miles northwest of Lynn;
Brook to North River and thus to the Atlantic Ocean at
tude, 80 feet above sea level; small. Salem sheet.
nty; in a swamp 3 miles southeast of West Boxford; outlet,
southwestward into Fish Brook (tributary to Ipswich River);
eet above sea level; very small. Lawrence sheet.
h County; town of Wareham; just south of Spectacle Pond
wam River to Wareham River and thus to Buzzards Bay)
rges by a short, northward flowing stream; small. Plymouth

er County; town of Sturbridge; principal inlet, stream from
of Walker Mountain; outlet, a stream half a mile long flowing
nebaug River (tributary through Shetucket River to Thames
Long Island Sound). The pond is about 1½ miles long and
average width. Brookfield sheet.
—Plymouth County; rises 2 miles southwest of South Middle-
vestward into the swamp that borders the northeast end of
utlet, Massapoisett River and thus to Buzzards Bay. Middle-

-Plymouth County; town of Carver; a very small pond one-half
kinco River. Plymouth sheet.
.—Worcester County; on Charles River (tributary to Boston
of Milford; one inflowing stream in addition to Charles River
nap; altitude about 270 feet. Blackstone sheet.
R.—Plymouth County; town of Lakeville; rises about a mile
ke; flows northwestward into Assonet River (tributary through
o Narragansett Bay); length, 4 miles. Middleboro and Taunton

orcester County; town of Upton; rises a mile north of Pratt Pond;
4½ miles into West River (tributary to Blackstone River and thus
k and Providence rivers to Narragansett Bay). Blackstone sheet.
.—Plymouth County; town of Plymouth; south of Center Hill
listance back of the beach. Plymouth sheet.
erkshire County; one-half mile north of Becket Center; a long
ischarging by a stream flowing northeastward 2 miles into West
field River (tributary through Westfield River to the Connecticut).

Chadwick Pond.—Essex County; one-half mile west of Dead Hill and about 1 miles south of Bradford; inlets, two small streams flowing in from the wes outlet, a stream 1 mile long to Johnsons Pond (tributary through an unname pond and stream to the Merrimack); altitude, 100 feet above sea level. Lawrence sheet.

Chaffin Pond.—Worcester County, 1 mile north of Winter Hill and about 5 mile north of Worcester; several small inflowing streams; outlet stream flows in genera northward about 2 miles into Quinapoxet River (tributary to Wachusett Reservoir); altitude 750 feet above sea level. Worcester sheet.

Chandler Pond.—Suffolk County; one-half mile north Chestnut Hill Reservoir; inle from Strongs Pond; outlet, a stream flowing northward into Charles River. Boston sheet.

Chapin Pond.—Hampden County; a small pond 1 mile east of north from Ludlow an 1½ miles north of Chicopee River (tributary to the Connecticut). Palmer sheet

Chappaquonsett Pond.—Dukes County; Marthas Vineyard; west of Vineyar Haven; a long narrow pond connected with Vineyard Sound by a short channel Marthas Vineyard sheet.

Charge Pond.—Plymouth County; town of Plymouth; one of a group of small pond in the southern part of the township west of Agawam River. Plymouth sheet

Charles Brook.—Hampden County; town of Brimfield; a stream less than a mil long flowing eastward into Hollow Brook at the head of Mill Brook (tributar through Quinebaug River to Shetucket River and through Thames River to Lon Island Sound.) Brookfield sheet.

Charles River.—Middlesex, Worcester, Norfolk, and Suffolk counties; rises in th town of Hopkinton, Middlesex County, at altitude 400 feet above sea level; flow southward about 9 miles through Cedar Swamp Pond, Factory, and several othe ponds unnamed on the map; then takes a very irregular course northeastward fo 27 miles to a point 2 miles east of Natick, where it drains Waban Lake, Morses Jennings, Mud, and Pickerel ponds; then flows generally east 12 miles, passin around Dedhams Island and continuing northwestward about 12 miles to Auburndale, where it expands into a pond or natural reservoir which is joined by small stream from Cambridge Reservoir. It then flows eastward about 14 mile into Boston Bay; total length, following the meanderings, about 75 miles; tota drainage area about 290 square miles; drainage area above Waban Lake, 156. square miles. Distributed along the river are 26 dams [1] aggregating in heigh 202 feet which furnish water power for numerous factories and mills. Principa tributaries, Mine and Sheppards brooks, Stop River, Bogastow, Stony, an Beaver brooks. Blackstone, Franklin, Framingham, and Boston sheets.

Charley Brook.—Bristol County; town of Attleboro; rises near Briggs Corner; flow in general northeastward into Wading River (tributary through Threemile Rive to Taunton River and thus to Narragansett Bay); length, about 4 miles. Taunton sheet.

Charlton Reservoir.—South; Worcester County; town of Charlton; village o South Charlton; two inflowing streams, one of which drains Gore Pond; outlet a stream flowing southeastward 1 mile, then northeastward 2 miles into Littl River (tributary through French River to Quinebaug River and thus through Shetucket and Thames rivers to Long Island Sound) near Buffumville. The reservoir is about 2 miles long and one-eighth mile wide. Webster sheet.

Chase Garden Creek.—Barnstable County; town of Yarmouth; a tidal channel in the marsh northeast of Yarmouth Port. Yarmouth sheet.

Chaubunagungamaug Lake.—Worcester County, town of Webster; the small inflowing streams include Sucker Brook and Browns Brook; outlet, Mill Brook to French River (tributary through Quinebaug River to Shetucket River and thus through

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[1] Clapp, F. G., Geological history of the Charles River: Tech. Quart., vol. 14, Nos. 3 and 4, pp 171-269, 1901.

ınd Sound). The lake is 2½ miles long, more than a
s very irregular in outline, and contains a number of
eet.

ounty; 1½ miles north of Westboro; outlet northward
artlett ponds by way of Stirrup Brook (tributary to
ough Concord River to the Merrimack); about one-half
de about 480 feet. Marlboro sheet.

ıty; 4 miles south of Ipswich; 3 miles northwest of
s from Round and Beck ponds; outlet, Essex River to
ıt 1 mile; maximum width, about one-half mile.

e County; town of Adams; a stream about a mile long
Hoosic River (tributary to the Hudson) 3 miles south
k sheet.

ounty; a tidewater channel between Chelsea and East
Revere and Beachmont to the mouth of Mystic River.
eets.

ınty; rises a mile west of Tullyville; flows east of south
th West Brook (tributary through Millers River to the
heet.

County; rises in the marsh 1 mile west of the village of
1½ miles, then south of east 1 mile into Stony Brook
r). Framingham sheet.

—Suffolk County; north of Chestnut Hill; a part of
r supply. Boston sheet.

and Franklin counties; rises in the town of Savoy;
iles, then northeastward 6 miles to its junction with
ry to the Connecticut) west of Charlemont; principal
ing brooks. Greylock and Hawley sheets.

n County; rises in a small pond southeast of Peaked
ly through the town of Monson into Quaboag River
pee River to the Connecticut) near Palmer; length, about
l from Tenth Census Report, volume 16, 1885, page 270;
r sheet, on which it is shown.

, Hampshire, Hampden, and Worcester counties; formed
mpden County by the union of Ware and Quaboag rivers;
ins the larger area and is therefore considered the con-
am, is formed at Barre Falls by the union of two branches;
ch rises in the town of Westminster, in Worcester County,
head of the western branch, flows southwesterly 10 miles
ong Meadow Brook, then turns abruptly and flows north-
; the course of the western branch is also southwesterly
n; from Barre Falls the Ware flows southwesterly by a
e Rivers; Swift River enters about a mile above Three
iver at Three Rivers. Below the mouth of the Quaboag
neral south of west to the city of Chicopee, where it enters
distance from the mouth of the Chicopee to the head of
/are River is 60 miles and the drainage area comprises 726
s follows:

	Square miles.
Three Rivers	221
mouth	213
r at mouth	210
r below Three Rivers	77

Average slope of river, 15 feet or more per mile. Principal tributaries the Ware above the mouth of Swift River: Burnshirt and Prince rivers, a Moose, Danforth, Muddy, Flat, and Beaver brooks, all from the north; the o tributary from the south draining any considerable area is Long Meadow Bro in the town of Rutland. Below Three Rivers the principal tributaries of Chicopee are Broad, Twelvemile, Higher, and Field brooks.

The drainage basin is hilly and contains many lakes and ponds, and the f of the stream is well sustained throughout the summer. Gaging stations: W River at Ware, 1904-10; Ware River at Gibbs Crossing, 1912-1915; Burnsh River near Templeton, 1909-1910; Swift River at West Ware, 1910-1915; Q boag River at West Warren, 1904-1907; Quaboag River at West Brimfield, 19 1915. Maps of basin: Warwick, Winchendon, Fitchburg, Worcester, Ba Belchertown, Webster, Brookfield, Palmer, and Springfield sheets. *See a* pages 117-149 of this report.

Childs Brook.—Hampshire County; rises in the central part of the town of Cu mington; flows southeastward 3 miles into Bronson Brook, the head of W Branch (tributary through Westfield River to the Connecticut). Chesterfi sheet.

Childs River.—Barnstable County; rises in John Pond; flows southward i Waquoit Bay and thus to Nantucket Sound; length to head of the bay, abou miles. Falmouth sheet.

Chilmark Pond.—Dukes County; Marthas Vineyard; the most western of a grou connected ponds on the south shore of the island; it receives at its western three small streams. Gayhead and Marthas Vineyard sheets.

Chockalog Pond.—Worcester County; a very small pond 4 miles southeast of E Douglas. Blackstone sheet.

City Brook.—Berkshire County; town of Mount Washington; head of Bashb Brook (tributary through Rocliff Jansen Kill to the Hudson). Sheffield shee

Clam Pudding Pond.—Plymouth County; town of Plymouth; 1 mile southeast Telegraph Hill. Plymouth sheet.

Clam River.—Berkshire County; rises in the town of Otis; southeast of Kingsb Mountain; flows southeastward 10 miles to a point three-fourths mile below N Boston, where it joins the Farmington River (tributary to the Connectic principal tributary, Buck River. Sandisfield sheet.

Clamshell Pond.—Worcester County; a small pond on North Brook (tribut through Assabet River to Concord River and thus to the Merrimack) about o half mile from its source and 1 mile south of Clinton; altitude, 360 feet ab sea level. Marlboro sheet.

Clapp Pond.—Berkshire County; town of Washington; 2 miles west of the villag Washington; principal inlet, Roaring Brook; outlet, Roaring Brook to Housato River; one-half mile long; one-eighth mile wide. Becket sheet.

Clapps Pond.—Barnstable County; in the marsh 1 mile west of Provinceto Provincetown sheet.

Clapps Round Pond.—Barnstable County; one of a group of ponds northwest Provincetown. Provincetown sheet.

Clark Brook.—Franklin County; town of Buckland; rises a mile southwest Moonshine Hill; flows northward 4 miles into Clesson Brook (tributary throu Deerfield River to the Connecticut) half a mile above its mouth. Hawley she

Clark Reservoir.—Worcester County; one-half mile east of Sutton; inlet, head Cold Spring Brook; outlet, Cold Spring Brook to Blackstone River (tribut through Seekonk River to Providence River and thus to Narragansett Ba Webster and Blackstone sheets.

Clay Pit Brook.—Middlesex County; a stream 2½ miles long rising northwest Lowell and flowing southward and eastward into Merrimack River one-half m southwest of Pawtucketville. Lowell sheet.

ounty; town of Plymouth; 1 mile northeast of East Carver.

Jounty; town of Carver; 2 miles northeast of the village
nouth sheet.
Jounty; 1½ miles southwest of Middleboro. Middleboro

County; town of Carver; a small pond 1 mile south of
ıth sheet.
ol County; towns of Seekonk and Rehoboth; rises about
ge of Seekonk; flows southeastward 1 mile, then east and
Palmer River (tributary through Warren River to Nar-
dence sheet.
sex County; formed by two branches, one of which rises
Hill and the other west of Arlington Heights; the branches
st of Wellington Hill and flow southeastward to Waverly,
rard to junction with Beaver Brook (tributary to Charles
length to head of longest branch, about 5 miles. Boston

n County; rises near the village of Hawley; flows north
heastward 2 miles, then by a very abrupt turn northeast
its junction with Deerfield River (tributary to the Con-
tributaries, Cooleys, Ruddock, Shepherd, and Clark
.
ounty; town of Plymouth; 1½ miles southwest of Great
h sheet.
County; 2 miles west of South Orleans. One-half mile
le long. Wellfleet sheet.
ster County; a large pond with very irregular outline,
sheet, U. S. Geological Survey, on the western border of
Mill Pond on the map), just north of Wachusett Reservoir;
ver and thus to the Merrimack. Marlboro sheet and map
listrict.
ıe town of Princeton in the northern part of Worcester
lope of Calamint Hill, at altitude about 1,030 feet above
ard into South Wachusett Brook (tributary through Quina-
o Wachusett Reservoir); length, about 3 miles. Worcester

County; rises on the north slope of Red Oak Hill, 1 mile
at altitude about 170 feet above sea level; flows southeast-
he town of Merrimac, into Merrimack River at Merrimac-
mouth, 150 feet. Haverhill and Newburyport sheets.
County; town of Brewster; halfway between the village
od Bay. Wellfleet sheet.
Jounty; town of Foxboro; inlet and outlet, Wading River
eemile River to Taunton River and thus to Narragansett

ex County; 2 miles east of Lawrence and 1 mile west of
wo small streams from the south and one from the north;
iver to Merrimack River; altitude, about 120 feet above
2½ miles; maximum width, 1 mile. Lawrence sheet.
sex County; rises in Cochichewick Lake, one-half mile
over and 2 miles east of South Lawrence, at altitude 100
ows northwestward 1½ miles along the northeast edge of
g through three small ponds and discharging into Merri-
e city of Lawrence. Lawrence sheet.

Cochituate, Lake.—Middlesex County; 3 miles east of Framingham in the Sudbu drainage basin; altitude, 134 feet above sea level; one of the reservoirs of tl storage system of the metropolitan district of Boston and vicinity; capacit 2,328,300,000 gallons. Framingham sheet.

Cochran Pond.—Hampden County; town of Blandford; a very small pond dischar ing by a stream flowing southeastward to Freeland Brook (tributary throu Black Brook to Westfield River and thus to the Connecticut). Granville shee

Coddings Brook. *See* Greenwater Pond.

Cohasse Brook.—Worcester County; town of Southbridge; rises in the northweste part of the town of Woodstock, Windham County, Conn.; flows southeastwa about a mile, thence northeastward 5 miles to its junction with Quinebaug Riv (tributary through Shetucket River to Thames River and thus to Long Islar Sound) at the city of Southbridge. Brookfield sheet.

Colchester Brook.—Plymouth County; town of Plympton; rises about a mile ea of the village of Plympton; flows in general north of west 5 miles into Wenatux River (tributary through Taunton River to Narragansett Bay) near South Halifa Middleboro sheet.

Cold Brook.—Middlesex County; rises near North Sudbury at altitude of 180 fe above sea level; flows southeastward 2½ miles to its junction with Pantry Bro (tributary through Sudbury River to Concord River and thus to the Merrimack Framingham sheet.

Cold Harbor Brook.—Worcester County; rises 3 miles north of Shrewsbury; tak a circuitous but in general easterly course to its junction with Assabet Riv (tributary through Concord River to the Merrimack) at Northboro; distance fro source to mouth in a straight line about 4 miles; along the course of the strear 8 miles; principal tributaries, stream from Rocky Pond, and Howard Broo Marlboro sheet.

Cold River.—Berkshire and Franklin counties; rises on the east slope of the Hoos Range in the northern part of the town of Florida; flows west of south 2 mile southeastward 5 miles, then in general eastward 4 miles to its junction wi Deerfield River (tributary to the Connecticut) a mile south of Zoar; princip tributaries, Tower, Gulf, Tanner, and Manning brooks. Greylock and Hawle sheets.

Cold Spring Brook.—Middlesex County; rises about 2 miles southwest of Ayer, altitude 260 feet above sea level; flows northeastward 2 miles into Bowers Bro (tributary through Nonacoicus Brook to Nashua River and thus to the Mer mack). Groton sheet.

Cold Spring Brook.—Worcester County; rises 1 mile southwest of the village Sutton; flows northeastward through Clark Reservoir and Pleasantdale Pond in Blackstone River (tributary through Seekonk River to Providence River ar thus to Narragansett Bay) near Wilkinsonville; length, about 4 miles. Webst and Blackstone sheets.

Coles Brook.—Berkshire, Hampshire, and Hampden counties; rises in Bens Pond, in the town of Washington; flows southeastward 5½ miles to its juncti with West Branch of Westfield River (tributary through Westfield River to tl Connecticut) 1 mile northwest of Bancroft. Becket sheet.

Coles River.—Bristol County; rises in the town of Dighton, flows west of south in Mount Hope Bay, Taunton River (tributary to Narragansett Bay); length, abo 10 miles; tidal in lower course. Taunton and Fall River sheets.

College Pond.—Plymouth County; town of Plymouth; one of a group of small pon in the west-central part of the township. Plymouth sheet.

ounty; formed in the town of Concord by the junction
rivers; Assabet River, which drains the larger area
d the continuation of the main stream, rises on the
, 4 miles southwest of Westboro, at altitude 360 feet
heastward about 30 miles to its junction with Sudbury
on Concord River flows northeastward 9 miles, then
nction with Merrimack River at Lowell.
hilly and broken country and has a rapid fall and high
Concord is also hilly and rolling near the mouth
ing rocky, the banks high, and the fall large, but
ream flows mostly through swamps and meadow lands
, its course very circuitous, and the bed sand and mud.
Concord near Lowell, where it has a fall of about 47
Wamesit Dam, under normal conditions of flow. (*See*
or records of flow.) Principal tributaries of the Con-
Assabet and Sudbury rivers, Page Brook and River
Framingham and Lowell sheets.
nty; rises on Perry Peak in the northwestern part of
ws southeastward 2 miles, then in general southerly
ond on Williams River (tributary to the Housatonic).

n County; town of Southwick; a group of four long
by short channels; the Massachusetts-Connecticut
n shore of the south and middle ponds; outlet, Great
(tributary to the Connecticut). The total length of
s; maximum width, less than one-half mile. Gran-

Connecticut lakes in northern New Hampshire; flows
ampshire and Vermont and across Massachusetts and
and Sound; length about 345 miles; drainage area,
ich 2,720 square miles is in Massachusetts; principal
mmonoosuc, Wells, White, Mascoma, Ottaqueechee,
t rivers, which join the main stream north of the
, Deerfield, Chicopee, and Westfield Rivers, which
chusetts, and Farmington River, which enters near
Connecticut lakes to Long Island Sound, about 1,900
tion in valley, about 40 inches, ranging from 35 inches
n to 45 inches at Hartford. Gaging stations at Holyoke
904–1915), Orford, N. H. (1900–1915). The following
area drained by Connecticut River in Massachusetts:
o, Vt., Keene and Monadnock, N. H., Hawley and
ick, Winchendon, and Fitchburg, N. H.-Mass., Ches-
chertown, Barre, and Worcester, Mass., Granville,
ield, and Webster, Mass.-Conn. *See* Report on Water
s, Tenth Census, vol. 16, pp. 46–135, 1885; *also* pages

ounty; rises in Long Pond in the town of Tewksbury,
ksbury Center; at altitude about 100 feet above sea
½ miles through a marsh and small pond, then gen-
into Shawsheen River (tributary to the Merrimack)
ille. A tributary of Content Brook along the south
with a stream flowing westward into Concord River.
y near its mouth. Lowell and Lawrence sheets.

Cook Pond.—Bristol County south of the city of Fall River; discharges by a str
passing through Globe Mill Pond under Laurel Lake Mill and Globe yarn m
and then crossing Bay Street near Sprague, reaches tidewater between S
and Middle Streets. Except at extreme high water, when the water from C
Pond backs through the swamps to the east and reaches South Watuppa P
by means of Sucker Brook, this pond has no direct connection with the Watu
ponds. *See* Report of Reservoir Commission to the city council of Fall Ri
Mass., July, 1902. Fall River sheet, U. S. Geological Survey.

Cooks Pond.—Plymouth County; town of Plymouth; three-fourths mile southea
Billington Sea. Plymouth sheet.

Cooleys Brook.—Franklin County; a stream about 1½ miles long, flowing south
ward into Cleeson Brook (tributary through Deerfield River to the Connectic
Hawley sheet.

Coonemosset Pond.—Barnstable County; town of Falmouth; outlet, a stream flo
southward into Great Pond and thus to Vineyard Sound. Falmouth sheet.

Coopers Pond.—Plymouth County; town of Carver; a small pond south of the vil
of North Carver. Middleboro sheet.

Copaum Pond.—Nantucket County; Nantucket Island; north shore; 2 miles no
west of the city of Nantucket; connected with the sound by a channel less t
one-eighth mile long. Nantucket sheet.

Copecut River.—Bristol County; rises 3 miles northeast of Copecut Hill in the t
of Fall River; flows southerly to its junction with Shingle Island River (tr
tary to East Branch of Westport River, and thus through Westport Harbor to
ocean) about a mile southeast of Hicksville; length, about 5 miles. Fall R
sheet.

Coskata Pond.—Nantucket County; Nantucket Island; on the Coatue sandbar; s
rated from the ocean on the east and from the bay known as Head of the Ha
on the south by bars about an eighth of a mile wide. Nantucket sheet.

Cotley River.—Bristol County; town of Taunton; rises a mile southwest of vil
of Lakeville; flows westward 2½ miles, then northward 3 miles into Taun
River (tributary to Narragansett Bay) 1 mile west of East Taunton. Taun
sheet.

Cotuit Ponds.—Barnstable County; town of Barnstable; three large ponds, the ce
one connects on the west with a stream flowing southeastward into Great
at the head of Osterville Harbor, on Nantucket Sound. Barnstable sheet.

Cotuit River.—Barnstable County; rises in Santuit Pond a mile north of the
lage of Cotuit, and flows southward and southwestward into an arm of Po
nesset Bay, Nantucket Sound; length, about 4 miles. Barnstable sheet.

Couch Brook.—Franklin County; rises in the town of Leyden, a mile north of F
zell Hill; flows south of east 2½ miles into Falls River (tributary to the Conne
cut). Greenfield sheet.

Cowesett Brook.—*See* Town River.

Cow Pond Brook.—Middlesex County; rises 2 miles northeast of Ayer on the n
slope of Snake Hill; flows northeastward through Cow Pond Meadows and C
Pond into Upper Massapoag Pond (tributary through Salmon Brook to the M
rimack; length, 5 miles; principal tributaries above Cow Pond, Martins P
Brook and Baddacook Brook. Groton sheet.

Cow Pond.—Middlesex County; 2½ miles east of Groton; inlet, Cow Pond Brook f
Cow Pond Meadows, and Baddacook Brook from Baddacook Pond; outlet, C
Pond Brook to Massapoag ponds and thus through Salmon Brook to the Me
mack; altitude, about 200 feet above sea level. Groton sheet.

Cows Creek.—Barnstable County; town of Sandwich; a channel in the marsh b
of Spring Hill Beach; connects with Long Creek. Barnstable sheet.

nty; rises 2 miles northwest of North Brookfield; flows
River (tributary through Chicopee River to the Con-
eld; length, 6 miles. Barre and Brookfield sheets.
2½ miles northwest of Manchester; outlet, a small stream
s through another small stream to Chebacco Lake and
feet above sea level; length, about one-half mile; maxi-
e-fourth mile. Salem sheet.
—Worcester County; town of Spencer; outlet, Cranberry
d River and thus through Quaboag River to Chicopee
ut. Brookfield sheet.
in County; 1 mile northeast of Mount Toby; outlet,
o Connecticut River. Greenfield sheet.
den County; southeastern part of the town of Tolland;
Farmington River (tributary to the Connecticut); small.

lk County; town of Braintree; outlet, a stream about 2
thwestward into the southern branch of Weymouth Fore
t.
outh County; town of Duxbury; inlet and outlet, South
ssachusetts Bay). Duxbury sheet.
outh County; town of Lakeville; between the southern end
l and Pocksha Pond. Middleboro sheet.
cester County; town of Lancaster; about one-half mile west
y small. Groton sheet.
K.—Franklin County; rises on the northeastern slope of
rtheastward 1 mile to Cranberry Pond, northwesterly about
esterly one-half mile into Connecticut River. Northampton
s.
rcester County; town of Spencer; rises in Cranberry Meadow
rd 2 miles, then northwestward 1 mile into the pond at the
field River (tributary through Quaboag River to Chicopee
e Connecticut). Webster and Brookfield sheets.
County; rises about 2 miles west of Danvers, at altitude about
evel; flows generally eastward 2½ miles to its junction with
m Crane River (a tidewater channel tributary to Essex Branch
antic Ocean at Beverly Harbor). Salem sheet.
ire County; one mile northwest of West Stockbridge; outlet, a
flowing northeastward into Flat Brook (the head of Williams
butary to the Housatonic). Pittsfield sheet.
County; formed by the junction of Crane and Beaver brooks,
vers; length, 1½ miles; joins Porter and Waters rivers to form
arm of Beverly Harbor. One mile above its junction with
forms a tidewater channel. Salem sheet.
kingham County, N. H., and Essex County, Mass.; rises in Rock-
N. H., in the town of Atkinson, at altitude about 310 feet above
enerally southward 2½ miles, passing through Creek Pond, in
ass., then generally east of south 2 miles into Merrimack River
st of Haverhill; fall from source to mouth, 290 feet. Haverhill

x County; in the town of Haverhill, 1 mile northeast of Ayers vil-
iles east of Spicket Hill; inlet, Creek Brook and another smaller
om the north; outlet, Creek Brook to Merrimack River; altitude,
above sea level; length, 1 mile; maximum width, one-half mile.
.

Crooked Pond.—Barnstable County; town of Falmouth; one of a group of po lying northwest of East Falmouth. Falmouth sheet.

Crooked Pond.—Essex County; 1½ miles south of Boxford; outlet, a small strean Fish Brook (tributary to Ipswich River); altitude, 140 feet above sea level; v small. Lawrence and Salem sheets.

Crooked Pond.—Hampshire County; northwestern part of the town of Plainfie outlet through Windsor Pond to Westfield River (tributary to the Connectic Hawley sheet.

Crooked Pond.—Plymouth County; town of Plymouth; a small pond 2 miles sou east of Great South Pond. Plymouth sheet.

Crooked River.—Plymouth County; town of Wareham; joins Wareham River (t utary to Buzzards Bay) south of Barneys Point; tidal; about a mile long. I mouth sheet.

Crooked Spring Brook.—Middlesex County; a stream about 1½ miles long risin miles northwest of Chelmsford Center and flowing northward into Stony Br (tributary to the Merrimack) near West Chelmsford. Lowell sheet.

Crow Hill Brook.—Worcester County; town of Templeton; a stream about 1½ m long rising east of Church Hill and flowing northeastward into Trout Brook (t utary through Otter River to Millers River and thus to the Connecticut). W chendon sheet.

Crows Pond.—Barnstable County; on Nickersons Neck in the town of Chath tidal. Chatham sheet.

Crystal Lake.—Middlesex County; at Newton Center. Boston sheet.

Crystal Lake.—Middlesex County; just south of the town of Wakefield; altitude, feet above sea level. The lake, when full, has an area of 85 acres; a portion of lake, covering about 30 acres, is very shallow; furnishes the water supply for town of Wakefield; natural outlet by a tributary of Saugus River, which charges into Boston Bay. Boston sheet.

Crystal Lake.—Worcester County; town of Gardner; north of the city of Gardn used by the city as a source of water supply; the lake is more than a mile l and one-fourth mile wide; altitude, 1,100 feet above sea level. Fitchburg she

Crystal Pond.—Middlesex County; in the city of Melrose; inlet Malden River; let Malden River to Mystic River; small. Also known as Ell pond. Bos . sheet.

Curtis Pond.—Hampshire County; 1½ miles north of Mount Pomeroy; inlet fr Warner Pond; outlet a stream one-half mile long flowing southwestward i the Middle Branch or head of Swift River (tributary through Ware River Chicopee River and thus to the Connecticut). Belchertown sheet.

Curtis Pond.—Worcester County; city of Worcester; principal inflowing strea Kettle Brook and Tatnuck Brook; outlet, Blackstone River to Seekonk Ri and thus through Providence River to Narranganset Bay. Webster sheet

Cushing Pond.—Plymouth County; town of Hingham; inlet and outlet, a branch Weir River. Abington sheet.

Cutler Pond.—Essex County; a very small pond 4 miles southwest of Ipswich Riv inlet, Black Brook; outlet, Black Brook to Ipswich River. Salem sheet.

Cut River.—Plymouth County; a tidal channel in Duxbury Marsh. Duxbury she

Cuttyhunk Pond.—Nantucket County; Cuttyhunk Island (one of the Elizabeth lands); tidal. Gay Head sheet.

Damlot Brook.—Bristol County; town of Raynham; rises 1½ miles east of villag Raynham; flows southwesterly into Taunton River (tributary to Narragans Bay); length, 3 miles. Taunton sheet.

Danforth Brook.—Worcester County; town of Hardwick; rises 1½ miles southwes Ridge Hill; flows west of south 6 miles into Ware River (tributary through Ch opee River to the Connecticut) at Gilbertville. Barre sheet.

ire County; rises in the town of Lanesboro; flows southeast-
tsfield, where it enters the northern arm of Lake Onota;
› west branch of Housatonic River (tributary to the Housa-
ittsfield sheets.

County; a tidewater channel formed by the junction of
ıters rivers; length about 1½ miles to the Atlantic Ocean at
joined at its mouth by Bass River from the north and North
Salem sheet.

›uth County; town of Middleboro; a stream about a mile long
into Bartletts Brook (tributary through Wenatuxet River
l thus to Narragansett Bay). Middleboro sheet.

County; town of Plymouth; just north of East Carver. Ply-

· County; town of Auburn; rises 1 mile northeast of Roch-
ward 1½ miles, thence northeastward through Stoneville
Brook (tributary through Blackstone River to Seekonk
;h Providence River to Narragansett Bay) near Stoneville;
ı. Webster sheet.

County; a small pond northeast of Harman Marsh Pond in
t of the town of Sheffield. Sheffield sheet.

ə County; town of Greenwich; an expansion of the Middle
ift River (tributary through Ware River to Chicopee River
ecticut) just above the mouth of the East Branch of Swift
sheet.

County; town of Chester; rises 1 mile southwest of North
asterly 3 miles, then northeastward one-half mile to Day-
Middle Branch of Westfield River (tributary through West-
nnecticut). Chesterfield sheet.

ıble County; town of Falmouth; a baylike pond connected
l by a narrow channel; one-fourth mile west of Falmouth
ıheet.

ıire County; rises in the town of Goshen; flows southward
hence southeastward into East Branch (tributary through
ıe Connecticut) one-half mile north of Bisbee Mill, in the
Chesterfield sheet.

County; a small pond in the town of Townsend lying a short
h from Bixby reservoir. Groton sheet.

Jounty; town of Hardwick; a small pond in an area drained
ıdy Brook to Ware River (tributary through Chicopee River
Barre sheet.

County; one-half mile north of Shirley reservoir; outlet, a
long flowing southwestward into Catacoonamug Brook (trib-
y reservoir to Nashua River and thus to the Merrimack).

e County; town of Mashpee; 1 mile northeast of Succones-
antucket Sound by a narrow ridge. Barnstable sheet.

x County; rises 2 miles south of Tyngsboro at altitude 150
flows southeastward 2½ miles and enters Merrimack River
rd. Lowell sheet.

County; town of Bourne; a small pond, 1½ miles southeast
rne. Falmouth sheet.

County; town of Falmouth; one of a group of ponds lying
almouth. Falmouth sheet.

County; town of Falmouth; one-half mile southwest of the
. Falmouth sheet.

Deerfield River.—Windham and Bennington counties, Vt., Berkshire and F
lin counties, Mass.; rises in the southeastern part of the town of Sunderland,
follows a general southeasterly course to its junction with the Connecticut
Greenfield, Mass.; length above the Massachusetts State line about 30 m
below the Massachusetts line, 42 miles. Gaging stations: At Hoosac Tu
1909–1913; at Charlemont, 1913–1915; at Shelburne Falls, 1907–1915; at Deer
1904–5. The most important tributaries in Vermont are the East Branch, w
enters at Searsburg, the North Branch, which comes in at Wilmington, an
West Branch, which joins it at Readsboro; principal tributaries in Massachu
Pelham Brook, Chickley River, Mill and Clesson brooks, and North, South,
Green rivers.

The basin is in large part wooded, and little land is under cultivation ex
along the lower stretches. Most of the slopes are steep, and elevation in the u
part of the basin exceeds 3,800 feet above sea level. Mean annual precipit
at the headwaters probably about 48 inches; in the lower part of the basin
several inches less; average depth of snowfall in January and February at J
sonville, Vt., about 25 inches; mean temperature for these months, abou
degrees.

Equinox, Londonderry, Bennington, Wilmington, Hawley, and Green
sheets. *See also* pages 89–116 of this report.

Deer Pond.—Plymouth County; town of Plymouth; in an angle on the north
of White Island Pond; very small. Plymouth sheet.

Demons Pond.—Worcester County; town of Rutland; one mile southeast of
Rutland; three small inflowing streams; outlet, a stream 1½ miles long flo
north and west into Long Pond (outlet Long Meadow Brook to Ware River and
through Chicopee River to the Connecticut). Worcester sheet.

Denison Lake.—Worcester County; town of Winchendon; 3 miles southwest o
city of Winchendon; two small inflowing streams; outlet, a stream one-fo
mile long flowing southwestward into Millers River (tributary to the Connecti
The lake is nearly a mile long and more than one-fourth mile wide. Winche
sheet.

Dennis Pond.—Barnstable County; town of Yarmouth; one-half mile sout
Yarmouth Port. Barnstable sheet.

Den Stream.—Hampshire County; town of Middlefield; rises 2 miles north o
village of Middlefield; flows southeastward 3½ miles, then northeastward 1½ r
into the Middle Branch of Westfield River (tributary through Westfield Riv
the Connecticut). Becket and Chesterfield sheets.

Devol Pond.—Bristol County; one-half mile east of and discharging into Sa
(Sandy) Pond; outlet through Watuppa Pond and Quequechan River to Tau
River and thus to Narragansett Bay. Fall River sheet. *See also* Report o
Reservoir Commission to the city council of Fall River, Mass., July, 1902.

Dickinson Brook.—Head of Munn Brook (tributary through Westfield Rive
Westfield River and thus to the Connecticut). Granville sheet.

Dimmick Pond.—Hampden County; town of Springfield; a small pond lying
a mile southwest of Ludlow and Chicopee River (tributary to the Connecti
Palmer sheet.

Dismal Brook.—Hampden County, Mass.; Hartford County, Conn.; rises on
south slope of Sodom Mountain, in the town of Southwick; flows southwa
miles to North Granby, Conn., where it enters the North Branch of Salmon B
(tributary through Salmon Brook to Farmington River and thus to the Conn
cut). Only about a mile of the head of this stream is in Massachusetts. G
ville sheet.

Dock Creek.—Barnstable County; town of Sandwich; a tidal channel in the m
east of Sandwich; connects with Mill Creek. Barnstable sheet.

outh County; town of Rochester; rises about 2 miles
e of Rochester; flows southeastward 3 miles, then north of
on River (tributary through Weweantic River to Buzzards
ary, a stream from Haskell Swamp. Middleboro and New

ster County; rises on the south slope of Oak Hill, in the
rs southeastward to Dorothy Pond, thence southwestward
(tributary through Seekonk River to Providence River
ett Bay) at Millbury; called Broad Meadow Brook above
to head of Broad Meadow Brook, 5 miles. Worcester,
ne sheets.

er County; at south base of Dorothy Hill; inlet, Broad
of Dorothy Brook); outlet, Dorothy Brook to Blackstone
gh Seekonk River to Providence River and thus to Narra-
r and Blackstone sheets.

ex County; rises in Long Pond 3½ miles northwest of
tward 1½ miles into Beaver Brook (tributary to the Mer-
t.

th County; formed in South Purchase Swamp by the
Gutter and East Rocky Gutter brooks. West Rocky Gut-
s the larger area, rises about 4 miles north of South Middle-
1½ miles, then southeastward and eastward through the
n with East Meadow Brook; below this junction Double
hrough a pond on the edge of the swamp into Weweantic
zzards Bay); length to head of West Rocky Meadow Brook,
eboro sheet.

n County; town of Shelburne; rises 2½ miles northeast of
southward 2 miles to the village of Shelburne, then south-
s junction with Deerfield River (tributary to the Connecti-
t.

ire County; town of Chesterfield; on The Branch, as the
(tributary through Westfield River to the Connecticut) is
ng and one-fourth mile wide. Chesterfield sheet.

ymouth County; formed by two small streams which
over; flows southward into a pond on Indian Head River
orth River to Massachusetts Bay); a western branch of
ains the eastern part of the town of Rockland. Abington

County; rises 2½ miles north of Windsor; flows northwest-
e Grove, where it enters Hoosic River (tributary to the
heet.

County; town of Sheffield; rises between Race Mountain
ws southeasterly 1 mile, then southerly 1 mile into Schenob
Housatonic). Sheffield sheet.

County; rises just south of the Vermont-Massachusetts
n Pond Mountain and East Mountain; flows southeast-
ction with Connecticut River in the town of Gill. Green-
ets.

County; town of South Hadley; a stream somewhat more
ng southwestward into Connecticut River at Thermopylae.

e County; town of Wellfleet; a tidal channel extending
to the village of Wellfleet. Wellfleet sheet.

Duck Hill River, or Back River.—Plymouth County; town of Duxbury; 1½ miles southwest of Duxbury station; flows in general northeastward discharges through Duxbury Marsh into Duxbury Bay, a branch of Massachu Bay; length, including major windings in the marsh, about 5 miles. Dux sheet.

Duck Pond.—Barnstable County; a small pond in the marsh one-half mile north of Provincetown. Provincetown sheet.

Duck Pond.—Middlesex County; on east edge of Cow Pond Meadows, which drained through Cow Pond Brook and Massapoag ponds to Salmon Brook, thus to the Merrimack. Groton sheet.

Dudley Brook.—Middlesex County; rises on the north slope of Nobscot Hil miles southwest of South Sudbury, at altitude 260 feet above sea level; generally northward 1½ miles, then eastward one-half mile into Hop Brook (utary through Wash Brook to Sudbury River and thus through Concord F to the Merrimack). Framingham sheet.

Dudley Pond.—Middlesex County; one-half mile north of Cochituate, 3 miles n west of Natick and 1 mile east of Sudbury River (tributary through Concord F to the Merrimack); altitude, 140 feet above sea level; part of the storage sy of the metropolitan district of Boston and vicinity. Framingham sheet.

Dug Brook.—Franklin County; town of Sunderland; rises 2 miles south of M Toby; flows southwestward to its junction with Connecticut River; lengt miles; principal tributary, Mohawk Brook. Northampton sheet.

Dunbar Brook.—Franklin County; rises in the town of Stamford, Vt., flows sc eastward (as Mill Brook) across the extreme northeastern corner of Berk County, and enters Deerfield River (tributary to the Connecticut) 1 mile sc east of Monroe Bridge; called Mill Brook throughout upper course; lengt head of Mill Brook, 6 miles. Greylock and Hawley sheets.

Dunn Brook.—Worcester County; rises 1 mile southeast of North Brookfield; southward to Perry Pond, thence southwestward into Quaboag River (tribu through Chicopee River to the Connecticut) just below the outlet of Qua Pond; principal tributary, Moore Brook; passes through the Great Swamp of Brookfield. Barre and Brookfield sheets.

Dunns Pond.—Worcester County; town of Auburn; 1 mile north of the villa Auburn; inlet and outlet, Ramshorn Brook (tributary to Kettle Brook and through Blackstone River to Seekonk and Providence rivers and Narraga Bay). Webster sheet.

Dyer Pond.—Barnstable County; a small pond about a mile east of the villa Wellfleet. Wellfleet sheet.

Eagle Pond.—Barnstable County; town of Barnstable; a small pond 1 mile nor Osterville Harbor. Barnstable sheet.

Eagle Pond.—Barnstable County; 1 mile west of North Harwich. Yarmouth s

East Branch.—Hampshire County; rises near the village of Goshen; flows south through Dresser Pond, thence southwesterly to its junction with Westfield F (tributary to the Connecticut); length, 10 miles; principal tributary, I Branch; called The Branch between Dresser Pond and the mouth of Dead Bra Chesterfield sheet.

East Brook.—Worcester and Hampden counties; rises 1 mile northwest of Ch berlain Mountain; flows southwesterly to its junction with Mill Brook (tribu through Quinebaug River to Shetucket River and thus through Thames Riv Long Island Sound) near the village of Brimfield; length, about 5 miles; princ tributary, Sessions Brook; passes through Great Pond. Brookfield sheet.

East Brookfield River.—Worcester County; the principal stream flowing Quaboag Pond; considered the continuation of Quaboag River. *See also* boag River.

ounty, Mass.; Rensselaer County, N. Y.; rises in the north-
n of Lanesb oro, Mass.; flows southwestward 5 miles into
en northwestward 2 miles to its junction with Kinderhook
Hudson). Berlin sheet.
outh County; on boundary between towns of Carver and
nkinco River to Wareham River and thus to Buzzards

unty; southeastern part of the town of New Marlboro, at
Volf Swamp; outlet, a stream one-half mile long flowing
ting River (tributary through Blackberry River to the
eld sheet.
County; town of Greenwich; 1 mile southwest of Green-
st Branch of Swift River (tributary through Swift River
s through Chicopee River to the Connecticut). Belcher-

ounty; Tuckernuck Island; northeast shore, tidal. Mus-

—Dukes County; Marthas Vineyard; the largest of the
south shore of the island; separated from the ocean by a
h; the pond is very irregular in outline, its northern and
racterized by branching coves. Marthas Vineyard sheet.
unty; town of Falmouth; a pondlike arm of Waquoit Bay
bout 1½ miles from a point near Menauhant. Falmouth

; Marthas Vineyard; north of Edgartown; a tidal pond on
own Harbor. Marthas Vineyard sheet.
unty; town of Plymouth; rises in Little South Pond, flows
South Pond, then circuitously eastward, northeastward,
westward into the southeast end of Plymouth Harbor;
Great Pond, 4½ miles. Plymouth sheet.
County; town of Plymouth; one-half mile west of Great
uth sheet.
County; town of Lakeville; outlet, a stream about 2 miles
into Long Pond (tributary through Assawompsett Pond
nd thus through Taunton River to Narragansett Bay).
he municipal supply of the city of Taunton. Middleboro

able County; town of Harwich; one-fourth mile south of
h sheet.
unty. *See* Crystal Pond.
ester County; town of Athol; rises on High Knob south of
s southwestward 1½ miles, then north of west 1 mile into
Millers River and thus to the Connecticut). Winchendon

County; town of Bourne; half a mile north of the head of
, with which it is connected by a southwestward flowing
eet.
ounty; town of Plymouth; west of King Pond. Plymouth

County; town of West Brookfield; rises on the south slope
utheastward 3 miles into Quaboag River (tributary through
Connecticut); principal tributary, Pierce Brook. Barre

Elm Brook.—Middlesex County; rises about one-half mile west of Bedford, at altitu about 120 feet above sea level; flows generally eastward 2 miles into Shawshe River (tributary to the Merrimack) about a mile east of Bedford; marshy throu much of its course. Framingham sheet.

Elmer Brook.—Hampshire County; town of South Hadley; rises west of The Not on the south slope of the Holyoke Range; flows southwestward 2 miles, westw 1 mile, and southward 1 mile into Bachelor Brook (tributary to the Connecticu a number of small tributaries from the south slope of the Holyoke Range. Nor ampton sheet.

Emerson Brook.—Worcester County; town of Douglas; rises 2 miles southeast East Douglas; flows southeastward 2 miles, northeastward 2 miles, then eastw and southeastward again 2 miles to its junction with Blackstone River (tribut to Seekonk River and thus through Providence River to Narragansett Ba Blackstone sheet.

Essex Branch.—*See* Danvers River.

Essex River.—Essex County; rises in Coys Pond, 2½ miles northwest of Manchest flows generally northeastward for about 7 miles into the Atlantic at Cross Isla passes through Round Pond and Chebacco Lake; drains Beck Pond through small tributary; swampy throughout its course; terminates in a tidewater chann Salem sheet.

Ezekiel Pond.—Plymouth County; town of Plymouth; one-eighth mile east of Wh Island Pond. Plymouth sheet.

Factory Brook.—Berkshire and Hampshire counties; rises in the southern part the town of Peru; flows east of south 8 miles through the town of Middlefield its junction with West Branch of Westfield River (tributary through Westfi River to the Connecticut) near Bancroft. Becket sheet.

Factory Pond.—Norfolk County; on Charles River (tributary to Boston Ba Blackstone sheet.

Fairhaven Pond.—Middlesex County; 1½ miles south of Concord (inlet, Sudbu River; outlet, Sudbury River to Concord River and thus to the Merrimack); abo three-fourths mile long and one-fourth mile in maximum width. Framingh sheet.

Fall Brook.—Bristol County; town of Freetown. *See* Namasket River.

Fall Brook.—Cheshire County, N. H., Worcester County, Mass.; rises in Whee Pond in the town of Richmond, N. H.; flows southeastward 3 miles into the E Branch of Tully River (tributary through Tully River to Millers River and th to the Connecticut). Warwick and Winchendon sheets.

Fall Brook.—Plymouth County; town of Middleboro; rises 1½ miles south of E Middleboro; flows eastward 1 mile, then southward 3 miles into Tispaquin Pon from which it passes westward into Namasket River (tributary through Taun River to Narragansett Bay); called Shorts Brook above Tispaquin Pond; leng to head of Shorts Brook, about 8 miles; principal tributaries, Woods, Story, a Shaving brooks. Middleboro sheet.

Fall Brook.—Worcester County; rises on the northeast slope of Rocky Hill; flo south of east 2 miles, then northeast and east about 2 miles to its junction w North Branch of Nashua River (tributary through Nashua River to the Me mack). Fitchburg, Worcester, and Groton sheets.

Fall Hill Brook.—Franklin County; town of Orange; a stream 1½ miles long, flow southward into Millers River (tributary to the Connecticut) at Orange. Warw sheet.

Falls River.—Windham County, Vt., Franklin County, Mass.; rises on the e slope of East Mountain, in the eastern part of the town of Guilford, Vt.; flo

ernardston, Mass., to a point opposite Turner Falls, where
iver; length, 13 miles; principal tributaries, Shattuck and
leboro and Greenfield sheets.

ester County; heads about 5 miles north of Fitchburg, at
ve sea level; flows southeastward into Baker Brook (tribu-
ranch of Nashua River to Nashua River and thus to the
l tributary, Scott Brook; length, about 2½ miles. Fitchburg

ex County; rises one-half mile east of South Chelmsford, at
sea level; flows northeastward 1¼ miles into River Meadow
gh Concord River to the Merrimack). Lowell sheet.

st Branch; Hampden County, Mass., Hartford County,
southwestern part of the town of Granville, Mass., by the
bbard brooks. Hubbard Brook, considered the continua-
ch of the Farmington, rises on the south slope of Barnes
of Tolland, and flows southeasterly about 6 miles; below
ook the East Branch of the Farmington flows southward 13
d, Conn., where it unites with the Farmington River (trib-
ut). In addition to Hubbard Brook the principal tribu-
ch of the Farmington in Massachusetts are Pond and Valley
d Granby sheets.

ssachusetts-Connecticut; heads in the town of Becket, near
erkshire County; flows southerly and southeasterly along
n Berkshire and Hampden counties, Mass., crosses the
itchfield County, Conn., and passes into Hartford County;
he southeasterly course is continuous to Farmington, where
ptly and flows northeastward to Tariffville. From Tariff-
rse is again southeasterly to Windsor, where the stream
t; length from source in Becket to the Connecticut, about
in, 584 square miles. Above Colebrook, where the stream
t, length is about 30 miles and the fall 700 feet. Total
chusetts, 103 square miles, of which 92.7 square miles lies
on 1 mile below New Boston; largest tributary in Massa-
The basin contains numerous small lakes and ponds, is
d a number of small power sites have been partly devel-
operation of Otis reservoir. Gaging station near New
apes of basin of West Branch, Becket, Sandisfield, Win-
ts. *See* Water Powers of the United States, Tenth Census,
. 181–185 of this report.

ty; Marthas Vineyard; south of Cottage City; separated from
beach. Marthas Vineyard sheet.

ounty; a pond at South Framingham; altitude, 149 feet
f the storage system of the metropolitan district of Boston
d by aqueduct with reservoirs 1 and 2 of the system. *See*
ingham sheet.

ounty; 1 mile southeast of Sherborn; outlet, a stream three-
g north of east into Charles River. Franklin sheet.

ounty; near Billerica Springs station, about 1½ miles north
ring Brook (tributary through Shawsheen River to the
bout 180 feet above sea level; very small. Lowell sheet.

ounty; town of Plymouth; one of a group of small ponds in
township west of Agawam River. Plymouth sheet.

Fearings Pond.—Plymouth County; town of Plymouth; one of a group of small po in the southern part of the township west of Agawam River. Plymouth shee

Federal Pond.—Plymouth County; on line between towns of Plymouth and Car outlet, a stream about a mile long, flowing southwestward into a pond on Sa son Brook (tributary through Weweantic River to Buzzards Bay); a large p of very irregular outline. Plymouth sheet.

Fenton Brook.—Berkshire County; southern part of the town of Egremont; rise Mount Bushnell; flows northwestward 1½ miles, thence northeastward one- mile into Karner Brook (the head of Hubbard Brook, which is tributary thro Schenob Brook to the Housatonic). Sheffield sheet.

Fever Brook, West Branch.—Worcester County; rises in the western part of town of Petersham; flows southwestward about 4 miles to the west base of Rat snake Hill, where it joins East Branch to form Fever Brook (tributary thro Middle Branch or head of Swift River to Ware River and thus through Chico River to the Connecticut). Belchertown sheet.

Fever Brook.—Worcester County; towns of Petersham and Dana; formed by branches. The East Branch, considered the head of the brook, flows from reservoir in the northern part of the town of Petersham, southwestward to south base of Rattlesnake Hill where it turns abruptly and flows northwestw 1 mile to its junction with the West Branch. Below this junction Fever Br flows southwestward somewhat more than a mile into the Middle Branch or h of Swift River (tributary through Ware River to Chicopee River and thus to Connecticut) south of North Dana. Winchendon, Barre, and Belchertown she

Field Brook.—Hampden County; town of Chicopee; rises 2 miles north of Ind Orchard; flows southwestward 4½ miles into Chicopee River (tributary to Connecticut) a mile east of Chicopee Falls. Springfield sheet.

Fife Brook.—Berkshire County; rises in the extreme southwestern part of the t of Monroe, in Franklin County; flows southeastward 2½ miles into Deerfield Ri (tributary to the Connecticut). Hawley and Greylock sheets.

First Brook.—Franklin County; town of Buckland; a stream about a mile long flow northward into Deerfield River (tributary to the Connecticut). Hawley sh

First Brook.—Franklin County; town of Whately; a stream about a mile long flow eastward into Connecticut River. Northampton sheet.

First Brook.—Plymouth County; town of Kingston: a stream about one-half long flowing northwestward into Jones River (tributary through Kingston Ba Massachusetts Bay), one-fourth mile below mouth of Second Brook. Plymo sheet.

First Herring Brook.—Plymouth County; rises one-half mile northeast of Bl Pond Hill; flows eastward and southeastward into North River in the tidal m above its mouth; length, about 5 miles. Abington and Duxbury sheets.

Fish Brook.—Essex County; rises about a mile east of Andover, at altitude 240 above sea level; takes a general course southeastward for 10 miles into Ipsw River; head of stream is called Mosquito Brook on the map; marshy through much of its course. Lawrence and Salem sheets.

Fish Brook.—Essex County; rises in Haggetts Pond, 3 miles southwest of So Lawrence, at altitude 120 feet above sea level; flows northwestward about 3 m into Merrimack River. Lawrence sheet.

Fishing River.—Rockingham County, N. H., Essex County, Mass.; rises in town of Plaistow in Rockingham County, N. H., at altitude about 160 feet ab sea level; flows southwestward 3 miles into Little River (tributary to the Me mack). Haverhill sheet.

Fish Pond.—Plymouth County; town of Plymouth; 2 miles southeast of the city Plymouth; outlet, a stream one-half mile long flowing southeastward into Pond on Eel River (tributary to Plymouth Harbor). Plymouth sheet.

County; 2 miles west of Clinton; one inflowing stream; out-
ɔng, flowing southeast and north of east into Coachlace Pond
tributary to Nashua River and thus to the Merrimack.

ɛn County; about a mile south of Chicopee River at Indian
sheet.
uth County; town of Plymouth; one of a group of small
ı part of the township west of Agawam River. Plymouth

ster County; rises 1½ miles north of Oakham; flows south-
nce somewhat west of south to its junction with East Brook-
through Quaboag River to Chicopee River and thus to the
Brookfield; passes through Brooks Pond and Furnace Pond;
cipal tributaries, Maynard and Horse Pond brooks. Barre

County; rises 1 mile northeast of Wachusett Pond, at alti-
above sea level; flows northeastward about 1½ miles into a
ım connecting Grass Pond with Whitman River (tributary
ı of Nashua River to Nashua River and thus to the Merri-
eet.
Middlesex County; a stream 1 mile long flowing southward
near Pawtucketville. Lowell sheet.
County, N. Y., Berkshire County, Mass.; head of Williams
ɘ Housatonic). *See* Williams River.
and Hampshire counties; rises in the southwestern part of
in Worcester County; flows southward 5 miles into Ware
ıgh Chicopee River to the Connecticut) in the town of
.nd Palmer sheets.
County; town of Mashpee; 1 mile west of Succonesset;
heet.
ounty; 2½ miles southwest of the village of Orleans. Well-

ounty; 1½ miles southeast of Townsend Harbor; two small
n 1 mile long flowing southwestward into Squannacook
gh Nashua River to the Merrimack). Groton sheet.
County; town of Bourne; a mile southeast of North Pocas-
th sheet.
County; town of Dennis; 2 miles south of Scargo Lake.

County; town of Harwich; one-half mile northwest of Har-
stream flowing southwestward into a branch of Herring
ıntucket Sound) in the marsh northeast of West Harwich.

County; town of Yarmouth; a small pond 1¼ miles north of
ıected with Lilly Pond by a marsh. Yarmouth sheet.
County; town of Yarmouth; 1 mile north of West Yar-
ɘet.
County; town of Wareham; a small pond lying between
ectacle Pond just north of Agawam. Plymouth sheet.
County; west of North Grafton; an expansion of Quinsiga-
to Blackstone River and thus through Seekonk and Provi-
ınsett Bay); just below the outlet of Lake Quinsigamond.

Flora Glen Brook.—Berkshire County; town of Williamstown; a stream 1½ m long, flowing eastward into Hemlock Brook (tributary through Hoosic Rive the Hudson); a mile southwest of the city of Williamstown. Greylock sheet.

Flushing Pond.—Middlesex County; 2 miles west of West Chelmsford at southe base of Flushing Hill; outlet, a stream one-half mile long flowing southeastw into Nabnasset Pond (tributary through Gilsons Brook to Stony Brook and t to the Merrimack). Lowell sheet.

Follins Pond.—Barnstable County; 2 miles northwest of South Dennis; on B River (tributary to Nantucket Sound). Yarmouth sheet.

Folsom Pond.—Middlesex County; 1½ miles northeast of Wayland; outlet, a stre 2 miles long flowing generally southwestward into Hayward Brook (tributary Sudbury River and thus through Concord River to the Merrimack); swam throughout lower part of its course; altitude, about 140 feet above sea level; v small. Framingham sheet.

Ford Glen Brook.—Berkshire County; town of Williamstown; rises a mile sou west of Northwest Hill; flows southeastward a mile, northeastward one-half m into Hemlock Brook (tributary through Hoosic River to the Hudson) just ab its mouth. Greylock sheet.

Forest Pond.—Essex County; just west of Middleton; inlets, two marshy stre entering from the west; outlet, a stream flowing eastward into Ipswich Ri altitude about 100 feet above sea level; length, about three-fourths mile; ma mum width, about one-fourth mile. Lawrence sheet.

Forest Pond.—Hampden County; town of Palmer; east of Ware River (tribut through Chicopee River to the Connecticut) with which it is connected; inflowing streams, one of which drains Calkins Pond; connected with Pa quattic Pond. Palmer sheet.

Forest River.—Essex County; a tidewater channel 2 miles west of Marblehe Salem sheet.

Forge Pond.—Bristol County; town of Raynham; an expansion of Pine Sw Brook (tributary through Taunton River to Narragansett Bay); southwest of village of Raynham. Taunton sheet.

Forge Pond.—Hampshire County; town of Granby; several small inflowing strea outlet, Bachelor Brook (tributary to the Connecticut) which flows through pond. Belchertown sheet.

Forge Pond.—Middlesex County; south of Forge Village; inlets, Beaver Brook Bennett Brook; outlet, Stony Brook to Merrimack River; altitude about feet above sea level; length, 1 mile; maximum width, one-half mile. Lo sheet.

Forges Pond; Bristol County; an expansion of Assonet River (tributary thro Taunton River to Narragansett Bay); 1½ miles northeast of Assonet vill Taunton sheet.

Forked Pond.—Nantucket County; Nantucket Island; south shore; separated f the ocean by a narrow beach. Nantucket sheet.

Fort Meadow Brook.—Middlesex County; rises about 1½ miles northwest of M boro, at altitude 280 feet above sea level; flows northeastward 5½ miles into Ass River (tributary through Concord River to the Merrimack) about 2 miles eas Hudson; passes through Fort Meadow Reservoir. Marlboro sheet.

Fort Meadow Reservoir.—Middlesex County; about 1½ miles southeast of Hud and 1 mile north of Marlboro; altitude 250 feet above sea level; inlet, Fort Mea Brook and several other small streams; outlet, Fort Meadow Brook (tribut through Assabet River to Concord River and thus to the Merrimack); len about 1½ miles; maximum width, one-half mile. Marlboro sheet.

ıddlesex County; rises in a swamp about 2 miles southwest of
ɜt altitude 260 feet above sea level; flows northeastward one-
nd, then takes an irregular course southward 6½ miles to South
Acton it flows generally eastward 4 miles to Assabet River
oncord River to the Merrimack); passes through Fort Pond,
ıouth of Long Pond, and through an unnamed pond one-fourth
ı; marshy through most of its course; principal tributaries,
Meadow, and Nashoba brooks. Groton and Framingham

County; 2½ miles south of Littleton Common; altitude 240
inlet, a stream 1½ miles long flowing southward from Long
Pond Brook (tributary through Assabet River to Concord
e Merrimack). Lowell and Framingham sheets.

County; 1 mile southeast of Lunenburg station; no outlet
phy indicates natural outlet northward through Turner Pond-
us through Nashua River to the Merrimack. Groton sheet.

re County; formed east of Amherst by the union of Adams and
ımethyst Brook, which drains the larger area and is therefore
nuation of the main stream, rises in the southern part of the
in Franklin County; flows southwestward 3 miles, then west
illage, where it receives Adams Brook. From this point Fort
gularly southwestward into Connecticut River about a mile
ım; length to head of Amethyst Brook, 15 miles. The river
l tributaries draining the north slope of Holyoke Range.
rthampton sheets.

ter County; town of Gardner; rises about a mile northeast of
flows southwestward into Otter River (tributary through
onnecticut); passes through a number of small ponds; prin-
r and Baker brooks. Fitchburg and Winchendon sheets.

ounty; about 2½ miles south of Andover, at altitude 80 feet
ıt, a stream about 1½ miles long from the north; outlet, a
ıwestward about 1 mile into a pond on Shawsheen River
rrimack) on the south slope of Pole Hill; southeast end of
ɪy. Lawrence sheet.

klin County; town of Coleraine; rises on Christian Hill;
½ miles into East Branch of North River (tributary through
ield River and thus to the Connecticut) at Foundry village.

ol County; town of Attleboro; rises 2 miles southwest of the
ws northwestward 1 mile, southwestward and westward 2
River (tributary to Tenmile River and thus through Seekonk
River which discharges into Narragansett Bay) near South
ce sheet.

klin County; rises on the west slope of Crag Mountain; flows
estward about 1 mile, then southward and southwestward
icut River at Northfield Farms. Warwick sheet.

County; in a swamp about 3 miles south of Georgetown;
ecting it with Spoffords Pond; outlet, Pye Brook (tributary
to Ipswich River); length, about one-half mile; maximum
th mile; altitude, about 120 feet above sea level. Lawrence

Fox Brook.—Worcester County; town of Blackstone; rises 1½ miles northwe Waterbug Hill; flows southeastward 3 miles, then somewhat east of south 2 to its junction with Blackstone River (tributary to Seekonk River and through Providence River to Narragansett Bay) near the city of Blacks Blackstone sheet.

Fox Creek.—Essex County; a tidal creek east of Tilton Hill; joins Ipswich at its junction with Treadwells Island Creek; connected by a canal with C Neck River, another tidewater channel. Salem sheet.

Freeland Brook.—Hampden County; rises 1 mile north of Blandford; flows so eastward 2½ miles, then northeastward 2 miles to Russell, where it joins B Brook (tributary through Westfield River to the Connecticut). Granville s

Freemans Brook.—Worcester County; town of Webster; rises near the city of ster; flows southward into the northern part of the town of Thompson, Wind County, Conn., then turns to the west and joins the French River (tribu through Quinebaug River to Shetucket River and thus through Thames Riv Long Island Sound) at Wilsonville; about 3½ miles long. Webster sheet.

Freemans Pond.—Barnstable County; town of Brewster; in the marsh north of Brewster; connected with Cape Cod Bay by a short stream. Wellfleet sheet.

French Brook.—Worcester County; rises about 1 mile east of Boylston Cente altitude about 620 feet above sea level; flows in general northwestward discharges into Wachusett Reservoir on Nashua River (tributary to Merri River); length, originally about 4 miles; partially flooded by Wachusett Reser Marlboro sheet and maps of Metropolitan Water District.

French River.—Worcester County, Mass., Windham County, Conn.; rises abo miles north of the village of Leicester; flows southward through Sargent Po Greenville Reservoir, thence southeastward through Rochdale Pond and a nu of ponds above North Oxford, then southward to its junction with Quine River (tributary through Shetucket River to Thames River and thus to Island Sound) at Mechanicsville, in the town of Thompson, Windham Cou Conn.; length about 26 miles; called Town Meadow Brook above Green Reservoir. The basin contains many ponds, the largest being Lake Chaub gungamaug. Webster and Putnam sheets.

French Stream.—Plymouth County; rises about 1 mile north of North Abin flows southeastward 2 miles into a pond south of Rockland; considered the of North River. *See* North River. Abington sheet.

Fresh Brook.—Barnstable County; rises 1½ miles southeast of South Wellfleet; westward into Cape Cod Bay; in salt marsh except at head. Wellfleet sheet.

Fresh Pond.—Barnstable County; south of South Dennis. Yarmouth sheet.

Fresh Pond.—Barnstable County; town of Falmouth; south of the village of mouth. Falmouth sheet.

Fresh Pond.—Middlesex County; west of Cambridge; connected by an arti channel with Alewife Brook (tributary to Mystic River); formerly part o reservoir system of Boston and vicinity; length, about one-half mile, n mum width about one-half mile. Boston sheet.

Fresh Pond.—Plymouth County; town of Plymouth; one-eighth mile east o south end of Beaver Dam Pond and one-half mile west of the beach. Plym sheet.

Fresh River.—Plymouth County; rises near Fort Hill in the town of Hing flows southwestward 1 mile, then westward one-half mile into Weymouth River. Abington sheet.

Frog Foot Brook.—Plymouth County; a stream about 2 miles long, rising i southwestern part of the town of Plymouth and flowing southwestward Tihonet Pond on Wankinco River (tributary through Wareham River to zards Bay). Plymouth sheet.

Essex County; rises 4 miles northwest of Beverly and flows
l 3 miles to a point just east of Danvers, where it forms a tide-
d Porter River (tributary to Essex Branch and thus to the
ter River. Salem sheet.

shire and Hampshire Counties; rises in the town of Peru 1½
Hill; flows southeastward 5 miles into the Middle Branch of
butary through Westfield River to the Connecticut). Becket
ets.

lin County; town of Hawley; a stream about 2 miles long,
nto Chickley River (tributary through Deerfield River to the
alf mile above the mouth of King Brook. Hawley sheet.

nouth County; town of Kingston; rises half a mile southeast
in general east of north 2 miles into Jones River (tributary
ay to Massachusetts Bay); passes through several small ponds.
mouth sheets.

outh County; town of Middleboro; an expansion of Fall
ook. Middleboro sheet.

outh County; town of Pembroke; inlet from No Bottom Pond
all pond about three-fourths mile east of its southern end.
arated from Oldham Pond and Great Sandy Bottom Pond
one-eighth mile wide. Abington sheet.

ester County; at East Brookfield; inlet, Fivemile River;
iver to East Brookfield River (tributary through Quaboag
River and thus to the Connecticut); the pond is nearly 1½
than half a mile wide at its northern end. Brookfield sheet.

tucket County; Nantucket Island; one of a series of tidal
end of the island. Muskeget sheet.

n County; the head of Orcutt Brook. *See* Orcutt Brook.

orcester County; town of Barre; rises 1 mile west of the
s southeastward 2 miles into Prince River (tributary through
pee River and thus to the Connecticut). Barre sheet.

outh County; town of Plymouth; west of north end of Long
eet.

County; just west of Salisbury and north of Amesbury;
outlet, Powow River to Merrimack River; length, 1½ miles;
out one-fourth mile; south end of lake lies between Whittier
titude, 100 feet above sea level. Newburyport sheet.

hire County; town of Monterey; south and west of Hunger
onkapot River to Housatonic River. The lake is nearly 2
t one-half mile in maximum width. Sandisfield sheet.

er County; rises about 1 mile north of Summit Station, on the
ester Railroad, at altitude 670 feet above sea level; flows some-
bout 3 miles into Wachusett reservoir. Worcester sheet and
water district.

r County; 2 miles southwest of Hudson, at altitude about 340
outlet, a small stream about 1 mile long flowing into Assabet
ough Concord River to the Merrimack); length, about three-
um width, about one-fourth mile. Marlboro sheet.

et County; Nantucket Island; 2½ miles northwest of Sias-
utline. Nantucket sheet.

lesex County; a stream about 1½ miles long flowing south-
Brook (tributary to Merrimack River) near West Chelmsford;
a stream from Nabnasset Pond. Lowell sheet.

Gleasons Pond.—Middlesex County; just east of Learned Pond and north of So Framingham; one-half mile southeast of Sudbury River (tributary through C cord River to the Merrimack); altitude, about 160 feet above sea level. Fr ington sheet.

Glen Brook, East Branch.—Franklin County; rises one-half mile southeas Frizzell Hill, in the town of Leyden; flows southwestward 2 miles into Glen B (tributary through Green River to Deerfield River and thus to the Connectic Greenfield sheet.

Glen Brook.—Franklin County; rises near the village of Leyden; flows irregul southward 6 miles to its junction with Green River (tributary through Deerf River to the Connecticut). Greenfield sheet.

Glen Lewis Pond. *See* Walden Pond.

Glenmere Lake.—Essex County; just north of the town of Lynn; inlets, two s streams, unnamed on the map, coming in from the north; outlet, Staceys Br which discharges into Nahant Bay; altitude, 60 feet above sea level; very sm Boston Harbor sheet.

Glen Pond.—Plymouth County; town of Wareham; one-half mile southwes White Island Pond; inlet, Agawam River; outlet, Agawam River to Warel River and thus to Buzzards Bay. Plymouth sheet.

Globe Brook.—Worcester County; rises on the southwest slope of Wheelock flows in general west of south into Quinebaug River (tributary through Shetu River to Thames River and thus to Long Island Sound) at the city of Southbri length, about 7 miles. Brookfield sheet.

Goddard Brook.—Franklin County; town of Montague; rises 2 miles northeast o village of Montague; flows northwestward one-half mile, then southwestwa miles into Saw Mill River (tributary to the Connecticut). Greenfield sheet.

Goddard Pond.—Worcester County; town of Grafton; inlet and outlet, Quinsigam River (tributary to Blackstone River and thus through Seekonk and Provid rivers to Narragansett Bay). Blackstone sheet.

Golden Cove Brook.—Middlesex County; rises one-half mile northeast of Chelms Center, at altitude 120 feet above sea level; flows eastward three-fourths into River Meadow Brook (tributary through Concord River to the Merrima marshy. Lowell sheet.

Goldthwait Brook.—Essex County; rises in Cedar Pond, 3 miles west of Peabod altitude 80 feet above sea level; flows generally eastward 3 miles to its junc with Proctor Brook to form North River (which joins the Atlantic Ocea Beverly Harbor); principal tributary, Tapley Brook. Salem sheet.

Goodell Hollow Brook.—Berkshire County; rises on the southwest slope of M Greylock; flows northwestward about 2 miles into Green River (tributary thr Hoosic River to the Hudson) 2 miles southeast of South Williamstown. Grey sheet.

Goodrich Hollow Brook.—Berkshire County, Mass., Rensselaer County, N. rises in Berry Pond, in the southeastern part of the town of Hancock; flows ward into Wyomanock Creek (tributary through Kinderhook Creek to the Huds length in Massachusetts, about 2 miles. Berlin sheet.

Goodrich Pond.—Berkshire County; east of Pittsfield; several inflowing stre outlet, a stream one-half mile long flowing northeastward into Housatonic Ri Becket sheet.

Goose Branch.—Bristol County; town of Norton; a stream about 2½ miles flowing northeastward into Wading River (tributary through Threemile Riv Taunton River and thus to Narragansett Bay) near Barrowsville. Taunton sh

Goose Pond.—Barnstable County; 1 mile northeast of South Chatham. Yarm sheet.

e County; 3 miles southeast of the city of Lee; inlet from
outlet, Goose Pond Brook to Coddings Brook (tributary to
Becket sheet.

3erkshire County; rises 1½ miles northwest of West Becket;
through Upper Goose Pond to Goose Pond, southwestward
, then northwestward to East Lee, where it joins Coddings
he Housatonic); length below Goose Pond, 2½ miles. Becket

Berkshire County; 4½ miles southeast of the village of Lee;
l, which discharges through Goose Pond Brook to Coddings
ousatonic River; a mile long and very narrow. Becket sheet.

County; town of Dudley; outlet to South Charlton Reservoir
liver (tributary through French River to Quinebaug River
etucket and Thames rivers to Long Island Sound). Webster

cket County; Cuttyhunk Island; separated from Buzzards
:. Gay Head sheet.

rcester County; rises about 2 miles southeast of Princeton
20 feet above sea level; flows southward about 2 miles into
ry to Quinapoxet River and thus to Wachusett reservoir).

n County; town of Warwick; the head of Moss Brook (tribu-
River to the Connecticut). Warwick sheet.

shire and Franklin counties; a stream about 1½ miles long,
slope of the Hoosac Range in the northeastern part of Berk-
owing eastward into Mill Brook (the head of Dunbar Brook,
erfield River to the Connecticut) at the village of Monroe.

ex County; rises about 1 mile west of Blanchard Hill, in the
ows southeastward 1 mile, then eastward about 1½ miles into
ary to the Merrimack). Groton sheet, on which it is called
Lowell sheet.

e County; three-fourths mile north of Harwich Port; at the
which is drained from the east end by a small stream flowing
icket Sound. Yarmouth sheet.

County; a large pond of very irregular outline which receives
chusett and Meeting House ponds and discharges by a stream
d to Whitman River (tributary through North Branch of
hua River and thus to the Merrimack); altitude, about 870
Fitchburg sheet.

le County; town of Dennis; 2 miles southeast of Scargo Hill.

ex County; a small pond about 2 miles northeast of West
t of Fort Pond Brook (tributary through Assabet River and
River to the Merrimack); altitude 240 feet above sea level.
am sheets.

h County; town of Plymouth; a small pond 1 mile south of
nouth sheet.

h County; town of Plymouth; one of a group of small ponds
f the township west of Agawam River. Plymouth sheet.

ounty; 2 miles northwest of Manchester; a short distance
ke (tributary to Essex River); altitude, 60 feet above sea
sheet.

Great Brook.—Franklin County; town of Shelburne; rises on the left slope Greenfield Mountain; flows southward 2 miles into Hawkes Brook (tribut through Dragon Brook to Deerfield River and thus to the Connecticut). Gre field sheet.

Great Brook.—Hampden County; rises in Congamuck ponds; flows west of no about 2 miles, then irregularly northeastward to Westfield, where it enters W field River (tributary to the Connecticut); length, 8 miles. Granville Springfield sheets.

Great Brook.—Worcester County; rises 1½ miles northeast of Summit Station; fl in general southeastward into Lake Quinsigamond (outlet, Quinsigamond Ri to Blackstone River and thus through Seekonk and Providence rivers to Na gansett Bay); length, about 4 miles. Worcester sheet.

Great Brook.—Worcester County; town of Brookfield; rises 1½ miles west of Wh ock Hill; flows northward 2 miles, then westward one-half mile into Quab Pond on Quaboag River (tributary through Chicopee River to the Connectic Brookfield sheet.

Great Drain.—Franklin County; town of Sunderland; rises near the village Sunderland; flows southwesterly into Connecticut River; 2 miles long. No ampton sheet.

Great Herring Pond.—Plymouth and Barnstable counties; inlet from Little H ring Pond; outlet, Monument River to Buzzards Bay; the pond is about 2 m long and less than one-half mile wide, and all except its southeastern end i Plymouth County. Plymouth sheet.

Great Mioxes Pond.—Nantucket County; Nantucket Island; one of the numer elongated ponds on the south shore of the island; separated from the ocean a barrier beach. Nantucket sheet.

Great Pond.—Barnstable County; a small pond in the marsh 1¼ miles northwes Provincetown. Provincetown sheet.

Great Pond.—Barnstable County; town of Barnstable; outlet, a stream flow southward and southwestward into Nantucket Sound, at the west side of N Harbor, near Osterville Landing; about 1¼ miles long and 1¼ miles in maxim width. Barnstable sheet.

Great Pond.—Barnstable County; town of Eastham; one of a group of ponds sout Eastham Center. Wellfleet sheet.

Great Pond.—Barnstable County; town of Falmouth; a pondlike bay connec by a narrow channel with Vineyard Sound. Falmouth sheet.

Great Pond.—Barnstable County; town of Wellfleet; 1¼ miles east of the vill of Wellfleet; connected with Long Pond by a short stream. Wellfleet sheet.

Great Pond.—Franklin County; town of Ashfield; northwest of the village of A field; two inflowing streams; outlet, South River to Deerfield River (tribut to the Connecticut). Hawley sheet.

Great Pond.—Franklin County; town of Montague; two inflowing streams, one which, the head of Pond Brook, flows through the pond to its junction with S Mill River (tributary to the Connecticut). Greenfield sheet.

Great Pond.—Hampden County; town of Brimfield; principal inlet, East Bro outlet, East Brook to Mill Brook (tributary through Quinebaug River to S tucket River and thus through Thames River to Long Island Sound). Brookfi sheet.

Great Pond.—Norfolk County; between the towns of Holbrook and Weymou two small inflowing streams, one of which is considered the head of Weymo Back River; outlet, Mill River (Weymouth Back River) to Whitman Pond. Weymouth Back River. Maximum length of Great Pond, 1¼ miles; altitu about 160 feet above sea level. Used as water supply for Weymouth. Abing sheet.

County; on line between towns of Randolph and Braintree;
a stream one-eighth mile long flowing northward into Wey-
in the swamp west of South Braintree. Dedham sheet.
D.—Plymouth County; a pond about 2 miles in greatest length
th, immediately south of eastern arm of Assawompsett Pond;
streams, Black Brook and a short stream from Little Quittacas
let, Mattapoisett River; water diverted from the Quittacas
cipal supply of New Bedford. Middleboro sheet.
Pond.—Plymouth County; immediately south of Oldham
urnace Pond; inlet from Little Sandy Bottom Pond. Abing-

Plymouth County; town of Plymouth; inlet from Little South
et, Eel River to Plymouth Harbor; about three-fourths mile
ile wide. Used as part of water supply of city of Plymouth.

—Essex County; rises in a swamp 2½ miles east of Georgetown,
above sea level; flows generally eastward 1½ miles into Mill
rough Parker River to Plum Island River and thus to the
arshy throughout most of its course. Salem sheet.
uth County; town of Carver; rises in Johns Pond about a
e of North Carver; flows somewhat west of north into Wena-
ary through Taunton River to Narragansett Bay); about 2
boro sheet.
x County; a tidewater channel from Plum Island River (sepa-
ntic Ocean by Plum Island). Salem sheet.
.—Plymouth County; towns of Duxbury and Marshfield;
ast of Cranberry Pond on South River; flows in general north-
Harbor Marsh, then southeastward through the marsh into
length, about 7 miles; total drainage area, above mouth
iles; the marshes lie just back of the seacoast line and are
ocean by Branch's and Hewitt's islands and by sand and
een the islands and north and south of them. The fresh-
r is very small. Duxbury sheet. *See also* Report of the Joint
the Harbor and Land Commissioners and the State Board
estoration of Green Harbor in the town of Marshfield, Mass.,

le County; town of Falmouth; a pondlike bay connected
d by a narrow channel. Falmouth sheet.
County; town of Montague; 1½ miles southwest of Millers
mile north of Great Pond. Greenfield sheet.
re County; rises on Pratt Hill, in the town of Lanesboro;
ugh New Ashford to South Williamstown, thence northeast-
with Hoosic River (tributary to the Hudson) at Williams-
12 miles; principal tributaries, East Branch, West Branch,
Berlin and Greylock sheets.
a County, N. Y.; Berkshire County, Mass.; rises in No Bot-
theastern part of the town of Austerlitz, N. Y.; flows west of
n River, thence southeasterly to the southern part of Great
here it joins Housatonic River; length, about 18 miles, of
of the Massachusetts-New York line; principal tributary in
nk Brook. The river furnishes part of the municipal sup-
reat Barrington. Pittsfield and Sheffield sheets.

Green River, East Branch.—Berkshire County; rises on the southeast slop Sugarloaf Mountain, in the town of New Ashford; flows northward 3 miles Green River (tributary through Hoosic River to the Hudson) 2 miles north of the village of New Ashford. Greylock sheet.

Green River, West Branch.—Berkshire County; rises in the northwestern pa the town of Hancock; flows southeastward 1 mile, then northeastward 5 mil South Williamstown, where it joins Green River (tributary through Ho River to the Hudson). Berlin and Greylock sheets.

Green River.—Windham County, Vt.; Franklin County, Mass.; rises on Hogh Mountain, in the town of Marlboro; flows in general southeasterly to its junc with Deerfield River (tributary to the Connecticut) at Greenfield; length miles, of which 13 miles is below the Massachusetts line; principal tributa West Hollow, Hibbard, Workman, Glen, Hinsdale, and Mill brooks. Wilm ton, Brattleboro, and Greenfield sheets.

Greenville Reservoir.—Worcester County; town of Leicester; principal in stream from Stiles Reservoir and Town Meadow Brook (head of French Riv outlet French River to Quinebaug River (tributary through Shetucket Riv Thames River and thus to Long Island Sound). Webster sheet.

Greenwater Pond.—Berkshire County; 1½ miles south of Becket Mountain; nat outlet, a stream about 5 miles long flowing north of west into Housatonic R at Lee. The outlet stream is not named on the map, but a manuscript repor the Pittsfield-Becket folio indicates that this is Coddings Brook, which nishes the municipal supply for the village of Lee. Becket sheet.

Grews Pond.—Barnstable County; one of a group of small ponds lying north of city of Falmouth. Falmouth sheet.

Griffin Brook.—Berkshire County; rises in the western part of the town of R mond; flows east of south 4 miles into Shaker Mill Pond (outlet Williams R to the Housatonic); passes through a pond that is a short distance north of Sh Mill Pond. Pittsfield sheet.

Griffiths Pond.—Barnstable County; town of Brewster; 1 mile east of West Br ter. Yarmouth sheet.

Guggins Brook.—Middlesex County; rises one-half mile northeast of Boxboro altitude 340 feet above sea level; flows southeastward 1½ miles, then eastwar miles into Fort Pond Brook (tributary through Assabet River to Concord R and thus to the Merrimack; marshy throughout much of its course. Marlboro Framingham sheets.

Guilder Brook.—Berkshire County; town of Mount Washington; a stream abo mile long flowing southwestward and joining City Brook to form Bashbish Br (tributary through Rocliff Jansen Kill to the Hudson). Sheffield sheet.

Guilder Pond.—Berkshire County; town of Mount Washington; between Mo Undine and Mount Everett. Sheffield sheet.

Gulf Brook.—Berkshire County; rises in South Pond, in the town of Florida; f southeastward 1 mile, then northeastward 1½ miles into Cold River (tribu through Deerfield River to the Connecticut). Greylock sheet.

Gulf Brook.—Franklin County; town of Orange; a stream about a mile long flov northward into Millers River (tributary to the Connecticut) at Orange. Warv sheet.

Gulf Brook.—Middlesex County; rises in Heald Pond in the town of Peppe flows northward about 2½ miles into Nissitisset River (tributary through Nas River to the Merrimack) in Hillsboro County, N. H. Groton sheet.

Gull Pond.—Barnstable County; town of Wellfleet; one of a group of ponds no east of the village of Wellfleet. Wellfleet sheet.

Gunners Exchange Pond.—Plymouth County; town of Plymouth; 1 mile south of Great South Pond. Plymouth sheet.

; town of Raynham; in Titicut Swamp; outlet, a stream
ugh the swamp, then west of south into Forge Pond
›utary through Taunton River to Narragansett Bay).

ıty; town of Salem; inlet, stream not named on map,
›t, stream flowing northeasterly to Spectacle Ponds
ır (tributary to the Connecticut). Warwick sheet.
ty; about 2½ miles west of Andover, at altitude 120 feet
nall streams, unnamed on the map; outlet, Fish Brook
iver); length, 1 mile; maximum width, one-half mile.

nty; town of Otis; a mile northeast of Benton Lake;
ıng flowing westward into the stream connecting White
Lake (outlet through Otis Reservoir to Farmington
necticut). Sandisfield sheet.
County; 1½ miles north of Hyannis. Barnstable sheet.
County; town of Yarmouth; a very small pond 2½
Yarmouth. Yarmouth sheet.
County; town of Plymouth; immediately west of Long
eparated by a narrow ridge; outlet, Agawam River to
ı to Buzzards Bay. Plymouth sheet.
County; town of Plymouth; central part of township;
Wareham River (tributary to Buzzards Bay); nearly a
ı one-half mile in maximum width; altitude, about 70

ounty; rises in the southern part of the town of Duxbury;
then southeastward 2 miles into Jones River (tributary
Massachusetts Bay), about a mile northeast of Kingston;
sett, Sampson, Mile, and Tussock brooks; passes through
ıgton and Duxbury sheets.
r County; rises about 2 miles south of Land Mine Moun-
d 4 miles into Quinebaug River (tributary through She-
s River, and thus to Long Island Sound). Brookfield

ımpden County; town of Holland; principal inlet, stream
nd Stevens Brook; outlet, a stream flowing northeastward
ıorthwestward and westward nearly a mile into Holland
›ok and thus through Quinbaug River to Shetucket River,
g Island Sound). The reservoir is about 2 miles long and
ıaximum width. Brookfield sheet.
›uth County; rises 1 mile west of South Wareham, flows
ın southeastward 1 mile into Weweantic River (tributary
ıcipal tributary, stream from Blackmore Pond. Middle-
sheets.
sex County; one-half mile southwest of Chestnut Hill;
, a stream about 5 miles long that winds very irregularly
ırd through Newton Center and Newtonville into Charles
›wn. Boston sheet.
hire and Hampden Counties; outlet through Horse Pond
ıgh Powder Mill Brook to Westfield River, and thus to the
mile long and one-half mile in in maximum width. Spring-

Harbor Pond.—Middlesex County; on Squannacook River (tributary thı Nashua River to the Merrimack) at Townsend Harbor; inlet from Bixby ı voir. Groton sheet.

Hardys Pond.—Middlesex County; north of Waltham; one inlet—the head of B Brook; outlet, Beaver Brook to Charles River. Boston sheet.

Harlow Pond.—Plymouth County; town of Plymouth; one-fourth mile we Cooks Pond; very small. Plymouth sheet.

Harman Marsh Pond.—Berkshire County; northwestern part of the town of field; two inflowing streams; outlet, a stream a mile long flowing southeast into Willard Brook (tributary through Hubbard Brook to Schenob Broo thus to the Housatonic). Sheffield sheet.

Harmon Pond.—Berkshire County; town of New Marlboro; outlet, a stream a long flowing northwestward to a branch of Konkapot River (tributary t Housatonic). Sandisfield sheet.

Harris Pond (now drained).—Franklin County; 1½ miles northwest of West Or formed by three inflowing streams, one of which, Moss Brook, passed throug pond to its junction with Millers River (tributary to the Connecticut). wick sheet.

Harris Pond.—Worcester County; town of Blackstone; an expansion of Mill (tributary to Blackstone River, and thus through Seekonk and Providence R to Narragansett Bay), north of the city of Woonsocket, R. I. Blackstone s

Hart Brook.—Hampshire County; rises on the north slope of the Holyoke R in the town of Amherst; flows northwestward 2½ miles into Fort River (trib to the Connecticut). Northampton sheet.

Hartwell Brook.—Franklin County; town of Charlemont; rises a mile northe Bald Mountain; flows southeastward 2½ miles into Deerfield River (tributa the Connecticut). Hawley sheet.

Hartwell Brook.—Middlesex County; rises about a mile south of Bedford at tude 150 feet above sea level; flows northeastward 1½ miles into Elm (tributary through Shawsheen River to the Merrimack; marshy through of its course. Framingham sheet.

Hastings Pond.—Franklin County; town of Warwick; a mile southeast of the v of Warwick; two small inflowing streams; outlet, Hodge Brook to Gales (the head of Orcutt Brook, tributary through Millers River to the Connect Warwick sheet.

Hatches Creek.—Barnstable County; a channel in the marsh 2 miles southw South Wellfleet. Wellfleet sheet.

Hatchet Brook.—Worcester County; town of Southbridge; rises in Hatchet in the northwest corner of the town of Woodstock, Windham County, C flows northeastward 4 miles into Quinebaug River (tributary through Shet River to Thames River, and thus to Long Island Sound), near the villa Westville. Brookfield sheet.

Hathaway Brook.—Plymouth County; town of Lakeville; a stream about a long flowing eastward into the stream connecting Elders Pond with Long (tributary through Assawompsett River to Namasket River, and thus th Taunton River to Narragansett Bay). Middleboro sheet.

Hawes Brook.—Norfolk County; rises in Buckmaster Pond, in the southwe part of the town of Dedham; flows in general east of south about 3 miles junction with Neponset River. Dedham sheet.

Hawkes Brook.—Essex County; rises on the eastern slope of Spicket Hill, Ayers Village, at altitude 200 feet above sea level; flows in a general southea direction about 4 miles into Marrimack River at Kimball Island, 3 miles east of Lawrence. Haverhill and Lawrence sheets.

County; rises 1 mile west of South Lynnfield; flows gen-
iles into Saugus River (tributary to Boston Bay) a short
trance to Prankers Pond. Lawrence and Boston sheets.
achusetts State Board of Health, 1895, p. 74.

lin County; town of Shelburne; rises on Brimstone Hill;
1½ miles into Dragon Brook (tributary through Deerfield
cut). Greenfield sheet.

er County; town of Dudley; outlet, a stream that passes
ponds to Larned Pond and thus through Merino Pond to
ary through Quinebaug River to Shetucket River and thus
r to Long Island Sound). Webster sheet.

County; south of Kingsbury Mountain; outlet, Hop Brook
Sandisfield sheet.

llesex County; rises 1½ miles east of Wayland, and 6 miles
titude about 140 feet above sea level; flows southwestward
d 1 mile through a swamp into Sudbury River (tributary
er to the Merrimack). Framingham sheet.

olk County; a tidal inlet connecting with Weymouth Fore
y Neck. Abington sheet.

len County; town of Russell; outlet, a stream 1 mile long
l into Potash Brook (tributary through Westfield River to
r Salmon Falls. Granville sheet.

x County; 2 miles west of Pepperell; outlet, Gulf Brook to
butary through Nashua River to the Merrimack). Groton

Hampshire County; a stream about 1 mile long, rising on
t Orient and flowing southwesterly and westerly into Adams
ugh Fort River to the Connecticut). Belchertown sheet.

ex County; rises in the town of Tewksbury, 1½ miles south
, at altitude about 100 feet above sea level; flows generally
into Shawsheen River (tributary to the Merrimack). Law-

ok.—Middlesex County; rises about 1 mile southeast of Box-
eet above sea level; flows southward 2 miles, eastward one-
eastward 2 miles into Fort Pond Brook (tributary through
cord River and thus to the Merrimack) one-half mile south
y near its mouth. Marlboro and Framingham sheets.

h County; town of Plymouth; inflowing stream drains two
stream half a mile long flowing northeastward into Plymouth
lymouth sheet.

x County; in a swamp 1½ miles north of Saxonville; outlet,
o Sudbury River (tributary through Concord River to the
, about 120 feet above sea level; length, one-half mile; max-
rth mile. Framingham sheet.

County; one-half mile west of Hartford station on the Wor-
ision of the Boston & Maine Railroad; outlet, a stream 1½
thwestward through a swamp into Nashua River (tributary
Groton sheet.

shire County; rises in the northwestern part of Williams-
ward 3 miles, then east of north about 3 miles to its junction
ibutary to the Hudson) a mile north ot the city of Williams-
eet Brook and Buxton Brook. Berlin and Greylock sheets.

Henshaw Pond.—Worcester County; town of Leicester; outlet, a stream 2½ long flowing west of south into Rochdale Pond on French River (tributary thr Quinebaug River to Shetucket River and thus through Thames River to Island Sound). Webster sheet.

Herring Brook.—Plymouth County; northern part of town of Carver; rises in ham Pond; flows southeastward a mile into South Meadow Brook (head of weantic River which is tributary to Buzzards Bay). Middleboro sheet.

Herring Brook.—Plymouth County; rises about 1 mile southwest of West bury; flows northwestward 4 miles into Indian Head River (North River); cipal tributaries, Pudding Brook, Little Pudding Brook, and Swamp B Abington sheet.

Herring Pond.—Barnstable County; town of Eastham; one of a group of p south of Eastham Center. Wellfleet sheet.

Herring Pond.—Barnstable County; town of Wellfleet; inlets from Slough and gins ponds; outlet, Herring River to Wellfleet Harbor, Cape Cod Bay. Wel sheet.

Herring Pond.—Barnstable County; 2 miles north of West Falmouth; outl stream flowing westward into Buzzards Bay. Falmouth sheet.

Herring River.—Barnstable County; rises in Long Pond; flows southwest through Hinckleys Pond to North Harwich, then very irregularly southward Nantucket Sound; length, about 6 miles. Yarmouth sheet.

Herring River.—Barnstable County; rises in the Mill ponds south of West B ster; flows northward through a marsh into Cape Cod Bay; a channel in the m connects Herring River with Quivett Creek; length of river from the bay to l end of the Mill ponds, about 1 mile. Yarmouth and Wellfleet sheets.

Herring River.—Barnstable County; town of Wellfleet; rises in Herring P flows southwestward and southward through the marshes north and west of fleet into Wellfleet Harbor, Cape Cod Bay. Wellfleet sheet.

Herring River.—Barnstable County; a channel in the marsh 1½ miles north of Harbor. Wellfleet sheet.

Hibbard Brook.—Franklin County; town of Leyden; a stream 1½ miles long, flo southwestward into Green River (tributary through Deerfield River to the necticut) southeast of West Leyden. Greenfield sheet.

Hicks Pond.—Worcester County; town of Charlton; a mile north of Charlton outlet, Cady Brook, to Quinebaug River (tributary through Shetucket Riv Thames River and thus to Long Island Sound). Webster sheet.

Higgins Pond.—Barnstable County; town of Wellfleet; one of a group of p northeast of Wellfleet village; outlet, through Herring Pond and Herring to Wellfleet Harbor, Cape Cod Bay. Wellfleet sheet.

Higher Brook.—Hampden County; rises in the town of Ludlow, on the south of Facing Hills; flows west of south 4 miles, northwesterly 2 miles, then so westerly and southerly 3 miles into Chicopee River (tributary to the Conn cut). Palmer and Springfield sheets.

Hinckley Pond.—Barnstable County; town of Barnstable; on the southeastern of the marshes. Barnstable sheet.

Hinckleys Pond.—Barnstable County; town of Harwich; inlet, Herring River Long Pond; outlet, Herring River to Nantucket Sound; about three-fourths long; nearly one-half mile wide. Yarmouth sheet.

Hinsdale Brook.—Franklin County; town of Shelburne; rises 2 miles northwe East Shelburne; flows southeastward 5 miles into Green River (tributary thr Deerfield River to the Connecticut); principal tributary, Allen Brook. Green sheet.

npden County; town of Holyoke; north of and connected
›utlet, Black Brook to Westfield River (tributary to the Con-
aller than Ashley Pond; principal inlet, the head of Black
sheet.

ıcket County; Nantucket Island; one of a series of tidal inlets
›f the island. Muskeget sheet.

›sex County; rises in the marsh northeast of the village of
eastward 1½ miles, then in general west of south 4 miles into
ary to Charles River). Framingham sheet.

›ter County; rises 1½ miles northeast of Walker Pond; flows
ıgh Walker Pond and the pond north of the village of Stur-
aug River (tributary through Shetucket River to Thames
›ong Island Sound); length about 5 miles. Brookfield sheet.

ıouth County; town of Pembroke; a small pond connected by
ıg stream with Herring Brook (tributary to North River).

ıouth County; town of Pembroke; three-fourths mile east of
ington sheet.

ee Town River.

·cester County; 2 miles west of Westboro; one inlet; outlet,
ıile long flowing northeastward to Assabet River (tributary
ver to the Merrimack). Marlboro sheet.

lin County; town of Warwick; rises in Hastings Pond; flows
en southward to its junction with Gales Brook (head of Orcutt
rough Millers River to the Connecticut); about 2 miles long.

›l County; town of Mansfield; rises 2 miles southwest of the
ows southward into Wading River (tributary through Three-
›on River and thus to Narragansett Bay); about 3 miles long.
and Taunton sheets.

uth County; town of Plymouth; 1½ miles southeast of Half-
ıth sheet.

r and Middlesex counties; rises about 2 miles west of Hudson
ıbove sea level; flows generally northeastward 1½ miles, then
le into Assabet River (tributary through Concord River to
southwest of Hudson. Marlboro sheet.

le County; two small ponds lying south of the village of
ıstable sheet.

Vorcester County; between Stone House Hill and Asne-
small inflowing streams; natural outlet, Tatnuck Brook to
ibutary through Seekonk River to Providence River and thus
r); used as a part of the water-supply system of Worcester.

›den County; town of Holland; north of the village of Hol-
rom Hamilton Reservoir; outlet, a stream flowing somewhat
h a swamp to Mill Brook (tributary through Quinebaug River
and thus through Thames River to Long Island Sound).

shire County; town of Lanesboro; a stream 2½ miles long
ırd into Sachem Brook (tributary through Pontoosuc Lake
Housatonic River and thus to Housatonic River). Berlin

pden County; towns of Wales and Brimfield. *See* Quinebaug

Homer Pond.—Dukes County; Marthas Vineyard; one of a series of ponds o south shore of the island, separated from the ocean by a continuous barrier b east of Tisbury Great Pond. Marthas Vineyard sheet.

Hood Pond.—Essex County; 4 miles southeast of Georgetown; inlets, two marshy streams coming in from the north; outlet, a small marshy stream t Brook (tributary through Mile Brook to Ipswich River); length about on mile; maximum width, about one-fourth mile. Salem sheet.

Hoop Brook.—Hampshire County; rises 2 miles south of Mount Lincoln; southwestward 1½ miles, westward 2 miles, thence northwestward 3 miles th Lawrence Swamp into Fort River (tributary to the Connecticut). Belche sheet.

Hooper Pond.—Plymouth County; town of Plymouth; a small pond 2 miles s east of Great South Pond. Plymouth sheet.

Hoosic River.—Rises about 2 miles northwest of Dalton, in Berkshire County, M at an altitude of 1,300 feet above sea level. Its general course lies first some east of north to North Adams, where it receives its North Branch, thence westward passing across the extreme southwestern corner of Vermont into selaer County, N. Y.; at the northern border of that county it turns and irregularly westward, joining the Hudson opposite Stillwater. The total l of the river to the head of the South Branch or main stream is about 56 its fall is 1,220 feet. Area of drainage basin, about 730 square miles (Ra principal tributaries, Little Hoosic and Walloomsac rivers and Tomhannock C all of which enter in the State of New York. The principal tributaries in M chusetts are North Branch of the Hoosic and Green rivers. Most of the tributaries are short and unimportant.

The country drained is to a great extent rugged and mountainous, the mits of the Taghkanick and Petersburg ranges attaining elevations of 1,0 2,000 feet above sea level, and the Ragged Mountains, south of North A culminating in Mount Greylock at 3,505 feet above sea. The immediate v of the Hoosic comprises a moderately hilly, open country, which is good fa land, even to the tops of the hills and is well cultivated.

The stream is one of the largest tributaries of the Hudson and, exceptin haps the Mohawk, is the most important in point of manufacturing. A share of the fall has been improved.

Tenth Census Report, vol. 16; Rafter, Hydrology of the State of New Bull. 85, N. Y. State Museum. Becket, Greylock, Berlin, Hoosic, and C sheets.

Hoosic River, North Branch.—Bennington County, Vt., Berkshire County, M rises in the town of Stamford, near Heartwellville, Vt., flows southwestw the city of North Adams, where it joins Hoosic River (tributary to the Hud length, 11 miles; principal tributaries in Massachusetts, Hudson and Hunte brooks. Bennington and Greylock sheets.

Hop Brook.—Berkshire County; rises in Hayes Pond south of Kingsbury Mou flows northwesterly through Tyringham into Housatonic River; length, 8 Sandisfield and Becket sheets.

Hop Brook.—Franklin County; town of New Salem; rises 2 miles northwest village of New Salem; flows southeasterly to Hop Brook Pond, then northea into the Middle Branch or head of Swift River (tributary through Ware Ri the Chicopee and thus to the Connecticut) at Millington; principal tribu Moose Horn Brook. Belchertown sheet.

Hop Brook.—Middlesex County; rises about one-fourth mile east of reservoir N 4 miles northwest of Framingham Center, at altitude 260 feet above sea l takes a very irregular course northward for 5 miles to its junction with Run B

eastward 2½ miles to its junction with Landham Brook
›utary through Sudbury River to Concord River and
marshy throughout part of its course; passes through
ipal tributaries, Run and Dudley brooks. Framingham

n County; town of New Salem; inlets, Moose Horn and
Brook to Middle Branch or head of Swift River (tribu-
to Chicopee River and thus to the Connecticut). Bel-

ınty; rises one-half mile south of Shrewsbury, on the
ll; takes a very circuitous but in general easterly course
›et River (tributary through Concord River to the Merri-
Northboro; principal tributary, Bummet Brook. Marl-

nty; rises a mile east of Wigwam Hill; flows southeastward
ry to Blackstone River and thus through Seekonk and
arragansett Bay) near East Blackstone; about 4 miles
.

County; formed in The Hopper by the union of small
stern slope of Mount Williams, Mount Fitch, and Mount
estward 2 miles, then northward 1½ miles into Green
h Hoosic River to the Hudson) at Sweets Corners. Grey-

ounty; town of Becket; 2½ miles east of Becket Center;
long flowing southeastward into Walker Brook (tributary
Westfield River to Westfield River and thus to the Con-
et.

County; on the southwest outskirts of Woburn; inlets,
tering from the west; outlet, a stream flowing southeastward
thus through Aberjona River and Mystic lakes to Mystic
ges into Boston Bay; altitude, 60 feet above sea level;
mile; maximum width, about one-fourth mile. Boston

rnstable County; town of Wellfleet; one of a group of
village of Wellfleet. Wellfleet sheet.

ymouth County; town of Carver; a stream about a mile
vard into a pond on South Meadow Brook (head of Wewean-
butary to Buzzards Bay). Middleboro sheet.

orcester County; town of North Brookfield; rises in Horse
North Brookfield; flows southeastward 3 miles into Five-
through East Brookfield River to Quaboag River and thus
er to the Connecticut). Barre sheet.

County; south of and connected with Hampton Pond
o Powder Mill Brook, which is tributary through Westfield
cut). Springfield sheet.

County; 2 miles north of North Brookfield; outlet, Horse
mile River (tributary through East Brookfield River to
thus through Chicopee River to the Connecticut). Barre

lk County; town of Randolph (?); 1 mile south of east of
inflowing streams, one of which is considered the head of
er; outlet, Weymouth Fore River. Dedham sheet.

Housatonic Branch.—Berkshire County; rises in the eastern part of town of I mond, one-half mile west of Osceola Mountain; flows west of north to Richı Pond, then winds northeasterly and easterly to the south border of the ci Pittsfield, where it joins the west branch of Housatonic River (tributa Housatonic River); length below Richmond Pond, 4½ miles; principal tribut Shaker, Phelps, and Smith brooks. Pittsfield sheet.

Housatonic Branch.—Berkshire County; rises in the town of Peru, 1½ miles s of the village of Peru; flows westward into Housatonic River in the town of I dale; about 4 miles long; principal tributary, stream from Ashmere I Becket sheet.

Housatonic River.—Berkshire County, Mass.; Litchfield, Fairfield, and Haven counties, Conn.; rises near Washington Station in the town of W ington; flows northward through Hinsdale to Dalton, thence southwestwa Pittsfield, where it receives a branch from the north (the west branch); th southerly to Long Island Sound in the vicinity of Stratford, Conn.; length a 125 miles; drainage area, 1,930 square miles; drainage area above Massachu State line, 532 square miles, of which 487 square miles is in Massachusett square miles in New York, and 12 square miles in Connecticut; principal t taries above Pittsfield, Housatonic Branch (Hinsdale), East Branch, West Bra below Pittsfield the principal tributaries in Massachusetts are Sackett B Yokum River, Hop Brook, Williams and Green rivers, Hubbard Brook, Konkapot River.

Some of the headwater streams rise at altitudes exceeding 2,000 feet a sea level. At Pittsfield the river is about 1,000 feet above sea level. The h water region is forested, but the lower part of the basin consists principal farm lands. Power has been developed at Housatonic, Great Barrington, a number of other places in Massachusetts.

Gaging stations: Great Barrington, Mass., 1913–1915, Falls Village, C 1912–1915.

Maps of basin: Berlin, Greylock, Becket, Pittsfield, Sheffield, Sandis Cornwall, Winsted, New Bedford, Waterbury, Danbury, Derby, Norwalk, Bridgeport sheets. *See* pages 33–40 of this report.

Housatonic River, East Branch.—Berkshire County; rises in the town of W sor; flows southwesterly to Dalton. where it joins the Housatonic; length, 8 n tributaries all short. Greylock and Becket sheets.

Housatonic River, West Branch.—Berkshire County; rises in the southwe part of the town of New Ashford; flows southerly to its junction with Housa River on the south border of the city of Pittsfield; passes through Ponto Lake; length, 12 miles; principal tributaries, Onota Brook and Housa Branch (Pittsfield). The name West Branch is here applied to this stream t tinguish it from the main Housatonic which drains the area lying east of I field, though no such distinction is made on the map. Berlin, Greylock, I field, and Becket sheets.

House Brook.—Middlesex County; rises 1½ miles southeast of South Chelms and about one-fourth mile north of Tophet Swamp, at altitude 160 feet abov level; flows northeastward three-fourths mile into River Meadow Brook (t tary through Concord River to the Merrimack). Lowell sheet.

Hoveys Pond.—Essex County; 1 mile northwest of West Boxford and 2 miles s west of South Groveland; outlet, a stream about a mile long that passes thr a very small pond and flows northeastward into Johnsons Pond (outlet thr a small stream to the Merrimack); altitude, 140 feet above sea level; very s Lawrence sheet.

ı County; town of Kingston; a stream about 2 miles long
ıto Jones River (tributary to Kingston Bay). Abington

r County; rises on the northwest slope of Mount Pisgah;
out 4 miles into Cold Harbor Brook (tributary through
ncord and thus to the Merrimack) just above the entrance
passes through two small lakes. Marlboro sheet.

ounty; a stream 1½ miles long in the marsh northeast of
(tributary to Ipswich River) is formed by the junction of
s. Salem sheet.

County; rises on the northeast slope of Mount Greylock;
miles to Adams, where it enters Hoosic River (tributary
lock sheet.

aire County; rises (as Karner Brook) in the northwestern
unt Washington; flows northerly into Egremont, easterly to
ı southeasterly to Sheffield, where it joins Schenob Brook
usatonic); called Karner Brook west of South Egremont;
rner Brook, 10 miles, principal tributary, Willard Brook;
ond northwest of Sheffield. Sheffield sheet.

den County; head of East Branch of Farmington River
armington River to the Connecticut). Granville sheet.

ngton County, Vt., Berkshire County, Mass.; rises in the
town of Stamford, Vt.; flows southeasterly 6 miles to North
e it joins North Branch of Hoosic River (tributary through
Hudson). Bennington and Greylock sheets.

ıcket County; Nantucket Island; an elongated pond separated
a narrow beach and extending in a northeasterly direction
across the western end of the island. Nantucket sheet.

Berkshire County, Mass.; rises in the northwestern part of the
; flows southeasterly 3 miles, then west of south 1½ miles to
e it enters the North Branch of Hoosic River (tributary through
the Hudson). Greylock sheet.

shire County, N. H., Worcester County, Mass. The contin-
ok—the head of East Branch of Tully River (tributary through
onnecticut River). *See* Tully River. Winchendon sheet.

.—Plymouth County; town of Carver; a stream 1½ miles long
vard into Stony Brook (tributary through Wenatuxet River to
d thus to Narragansett Bay). Middleboro sheet.

nouth County; town of Plymouth; rises in the eastern part of the
ortheastward 2½ miles and discharges into Cape Cod Bay north
Plymouth sheet.

.—Plymouth County; rises in Maquan Pond; flows southwest-
ead Pond, then westward and northward through the pond near
ction with Indian Head River (tributary through North River to
y); length, about 5 miles. Abington sheet.

—Plymouth County; town of Hanson; inlet from Maquan Pond;
ead Brook to Indian Head River and thus through North River
Bay. Abington sheet.

.—Plymouth County; the middle stretch of North River, q. v.
ributaries of Indian Head River are Drinkwater River, Indian
d Herring Brook. Abington sheet.

Indian River.—Essex County; rises on the southwest slope of Archeland Hill, 1 r east of West Newbury, at altitude 140 feet above sea level; flows westward half mile, then generally northward 2½ miles, passing along the west slop Pipestave Hill and discharging into Merrimack River about 3½ miles west of N buryport. Newburyport sheet.

Ipswich River.—Middlesex and Essex counties; rises 2 miles southwest of Wilming Center, at altitude 120 feet above sea level; flows generally eastward 13 m northward 5 miles, then eastward 5½ miles into Wenham Swamp; between point and the mouth it has a drainage area of 96.7 square miles. From Wenl Swamp it takes a general course north of east for 10 miles to the Atlantic; ma throughout most of its course; principal tributaries, Maple Meadow, Lubl Bear Meadow, Martins, Wills, Boston, Fish, Mile, Howlett, and Black bro and Miles River. Lawrence and Salem sheets.

Ironstone Reservoir.—Worcester County, Mass., and Providence County, R one inflowing stream; outlet a stream one-half mile long flowing northeastv into Blackstone River (tributary through Seekonk River to Providence River thus to Narragansett Bay); the reservoir is about 2 miles long and one-eighth in maximum width. Blackstone sheet.

Ironwork Brook; Berkshire County; town of Sheffield; rises in the northeas part of the township; flows southward 3 miles, then southwesterly, westerly, southerly 2½ miles into Housatonic River. Sheffield sheet.

Island Creek.—Plymouth County; town of Duxbury; rises 1 mile west of the s end of Island Creek Pond; flows eastward into the pond, and then southward Kingston Bay, a branch of Massachusetts Bay; length, 2 miles. Duxbury sl

Island Creek Pond.—Plymouth County; town of Duxbury; one inflowing str considered head of Island Creek; outlet, Island Creek to Kingston Bay, a br of Massachusetts Bay. Duxbury sheet.

Island End River.—Middlesex County; a short tidal creek just west of Che about a mile long; joins Mystic River opposite Charlestown. Boston sheet.

Island Pond.—Plymouth County; town of Plymouth; one-fourth mile west of n end of Great Herring Pond. Plymouth sheet.

Island Pond.—Plymouth County; town of Plymouth; 1 mile south of Beaver I Pond. Plymouth sheet.

Island Pond.—Plymouth County; town of Plymouth; 1½ miles east of the s end of Great South Pond; inlet, a short stream flowing eastward from Jen Hole. Plymouth sheet.

Israels Pond.—Barnstable County; 2½ miles north of Hyannis; near Yarm Camp Grounds. Barnstable sheet.

Jabish Brook.—Hampshire County; rises on the east slope of Mount Lincoln in town of Pelham; flows in general southeasterly 13 miles to a point one-fo mile east of Barretts Junction, where it enters Swift River (tributary through V River to Chicopee River and thus to the Connecticut). Belchertown and Pal sheets.

Jack Brook.—Franklin County; rises on the east slope of Brush Mountain; flows of south 3 miles into Keyup Brook (tributary through Millers River to the necticut). Warwick sheet.

Jacob Pond.—Plymouth County; northeast of Assinippi; inlet and outlet, T Herring Brook (tributary to North River). Abington sheet.

Jamaica Pond.—Suffolk County; west of Jamaica Plain; outlet through a chai small ponds and the Back Bay Fens to Charles River. Boston sheet.

James Brook.—Middlesex County; rises about one-half mile northeast of Gro flows southward 3 miles, then westward 1½ miles into Nashua River (tributar the Merrimack). Groton sheet.

le County; a small pond three-fourths mile west of South
th mile from Long Pond. Yarmouth sheet.

ounty; Marthas Vineyard; northern part of West Tisbury;
eyard Sound through a channel into Lamberts Cove. Mar-

uth County; town of Plymouth; 1 mile east of the south end
d; outlet eastward to Island Pond. Plymouth sheet.

table County; town of Falmouth; 1¾ miles northwest of East
th sheet.

llesex County; 1½ miles northeast of Natick; inlet, stream
o small lakes in the marsh northwest of the pond; outlet, a
ile long flowing southeastward into Morses Pond (tributary
ke to Charles River). Framingham sheet.

kes County; Marthas Vineyard; one of a series of ponds on
the island, separated from the ocean by a continuous barrier
stance west of Edgartown Great Pond. Marthas Vineyard

le County; 3 miles north of Waquoit village; about a mile
two outlets, one (Childs River) flowing from the south end,
et River) flowing eastward through a marsh and then south-
th end; both rivers discharge through Waquoit Bay into Nan-
lmouth sheet.

ble County; town of Mashpee; at the head of an eastern arm of
Nantucket Sound. Barnstable sheet.

sex County; 2½ miles southeast of Bradford, and just southwest
ets, streams from Hoveys and Chadwick ponds, and a small
nnamed pond; outlet, a stream that passes through several
nd flows northward 1½ miles into Merrimack River, one-fourth
eland; altitude, 80 feet above sea level; length, about 1 mile;
about one-half mile. Lawrence sheet.

uth County; town of Carver; about a mile south of village of
tlet, Green Brook to Wenatuxet River (tributary through Taun-
agansett Bay). Middleboro sheet.

nnel in the marsh northeast of Yarmouth Port; connects with
ek. Yarmouth sheet.

lymouth County; town of Wareham; a small pond without
utlet, used by Onset as a source of municipal water supply.

.—Plymouth County; rises in the town of Plympton; flows
miles, northward 1½ miles, then northeastward 1 mile into
utary through Kingston Bay to Massachusetts Bay). Middleboro

x County; a tidewater channel about 1½ miles long, one arm of
with Little River and another arm with Squam River. Jones
Squam River at its mouth. Pierce Island is formed by the two
am and Jones Rivers. Gloucester sheet.

mouth County; town of Kingston; the natural outlet of Silver
er Lake. The general course of the river is eastward and it
Kingston Bay; the head of the river above Silver Lake is called
Brook; principal tributary, Jones River Brook. Abington,
l Plymouth sheets.

Jordan Pond.—Worcester County; town of Shrewsbury; a small pond one-four mile east of Lake Quinsigamond (tributary through Quinsigamond River Blackstone River and thus through Seekonk and Providence rivers to Nar ganset Bay) into which it discharges by a westward flowing stream. Marlbo sheet.

Juniper Pond.—Berkshire County; town of New Marlboro; one inlet; outlet, stream 1½ miles long flowing southward into Konkapot River (tributary to t Housatonic) at Mill River village; very small. Sheffield sheet.

Justice Brook.—Worcester County; rises about 3 miles southwest of Leominster, altitude 810 feet above sea level; flows in general southerly to its junction wi Stillwater River (tributary to Wachusett reservoir); passes through two pon Fitchburg and Worcester sheets.

Karner Brook.—Berkshire County; head of Hubbard Brook (tributary throu Schenob Brook to Housatonic River). Sheffield sheet.

Kearney Brook.—Hampshire County; rises on Bryant Mountain in the weste part of the town of Cummington; flows southeastward 3 miles into Bronson Broo the head of West Branch (tributary through Westfield River to the Connecticu Chesterfield sheet.

Keen Brook.—Plymouth County; rises north of West Duxbury; flows northeastwa 2 miles into South River (tributary to Massachusetts Bay). Abington a Duxbury sheets.

Kelleys Pond.—Barnstable County; south of West Dennis; outlet southward in the small marsh lying east of the mouth of Bass River. Yarmouth sheet.

Kendall Pond.—Worcester County; 1 mile east of the village of East Templeto outlet, a stream one-eighth mile long flowing northeastward into Otter Riv (tributary through Millers River to the Connecticut). Winchendon sheet.

Kenoza Lake.—Essex County; one-half mile northeast of Haverhill, 1½ miles nor of Merrimack River; altitude, about 120 feet above sea level; length, about mile; maximum width, one-half mile. Haverhill sheet.

Kettle Brook.—Worcester County; rises on the west slope of Little Asnebumsk Hill; flows southeastward through many small ponds to Stoneville; thence ea ward and northward to its junction with Blackstone River (tributary through Se konk and Providence rivers to Narragansett Bay) in the southwestern part of t city of Worcester; principal tributaries, Lynde, Dark, and Ramshorn brook Worcester and Webster sheets.

Keyes Brook.—Middlesex County; rises on the northwest slope of Snake Meado Hill, 2 miles northwest of Graniteville; flows very irregularly northeastwa to Keyes Pond, thence southeastward to Stony Brook (tributary to the Merrimac near Westford station. Called Meadow Brook above Keyes Pond. Length head of Meadow Brook, 4½ miles; below Keyes Pond, 2 miles. Lowell sheet.

Keyes Brook.—Worcester County; rises in a pond 1 mile east of Wachusett Po in the town of Princeton, at altitude about 810 feet above sea level; flows sout eastward about 1½ miles into the lake at East Princeton that forms the head Stillwater River (tributary to Wachusett reservoir). Fitchburg and Worcest sheets.

Keyes Pond.—Middlesex County; 1½ miles north of Graniteville; inlet, Meado Brook (head of Keyes Brook) and Spaldings Brook; outlet, Keyes Brook Merrimack River; altitude, 180 feet. Lowell sheet.

Keyup Brook.—Franklin County; towns of Northfield and Erving; rises 1 mi south of Alexander Hill; flows southward into Millers River (tributary to th Connecticut) at Erving; principal tributary, Jack Brook; 5 miles long. Warwic sheet.

unty, Mass., and Bristol County, R. I.; rises in Warren
vansea; flows southwestward to Warren, thence south-
ay through Mount Hope Bay; tidal in its lower course.
Bay sheets.

inty; town of Warwick; a stream about a mile long, flow-
with Mountain Brook to form Mirey Brook (tributary
the Connecticut). Warwick sheet.

nty; rises in a small pond 3½ miles east of Concord and
at altitude about 160 feet above sea level; flows north-
ard about a mile into Shawsheen River (tributary to
near its junction with the Shawsheen. Framingham

y; 1 mile north of Merrimacport and 2 miles west of
n about 1 mile long flowing in from the northwest;
Powow River (tributary to the Merrimack); altitude,
length, three-fourths mile; maximum width, one-half
t.

ity; rises in Plainfield Pond north of West Mountain;
, then northerly 2 miles into Chickley River (tributary
o the Connecticut); tributary, Basin Brook. Hawley

ty; town of Plymouth; 2 miles southwest of Billington

ounty; rises in the swamp east of Pattaquattic Hill;
les, then southeastward 2½ miles into Quaboag River
ee River to the Connecticut) about a mile south of
sheet.

ounty; a small pond lying 1 mile south of Charles River
Medway. Franklin sheet.

y; town of Raynham; an expansion of Pine Swamp
Taunton River to Narragansett Bay); north of the village
eet.

and Berkshire counties; rises 1½ miles west of Ring-
5 miles to Dayville, where it enters Middle Branch of
through Westfield River to the Connecticut). Chester-

County, rises on the north slope of Rounds Rock, in
eastward 3½ miles to Cheshire, where it enters Hoosic
Hudson). Greylock sheet.

er County; rises 1½ miles north of Crystal Lake in the
thwestward into Otter River (tributary through Millers
west of the city of Gardner; principal tributary, Wilder
st above its mouth. Fitchburg and Winchendon sheets.

nty; south end of Cow Pond Meadows; 2½ mile south-
Springy Pond; outlet, a stream about one-eighth mile
rd into Cow Pond Brook (tributary through Salmon
in Cow Pond Meadows. Groton sheet.

e County; rises in the eastern part of the town of Great
rd 6 miles into Housatonic River in the southern part of
; principal tributary, Agawam Brook. Sheffield and

Konkapot River.—Berkshire County; rises in Lake Garfield, in the town of Monter flows southwesterly through Monterey and New Marlboro to the village of Soc in North Canaan, Conn., where it turns and flows northwesterly into Berks County, Mass., and joins Housatonic River near Ashley Falls in the southeast part of the town of Sheffield; length below Lake Garfield, about 18 miles; princ tributaries, Rawson Brook, and stream from Lake Buell. The drainage b lies almost entirely in Massachusetts. Sandisfield and Sheffield sheets.

Labor in Vain Creek.—Bristol County; town of Somerset; a stream about 3 m long flowing southeastward into Taunton River (tributary to Narragansett at Somerset. Taunton sheet.

Labor in Vain Creek.—Essex County; rises 1 mile southeast of Ipswich and fl generally northward 1½ miles into Ipswich River; marshy throughout its cou Salem sheet.

Lagoon Pond.—Dukes County; Marthas Vineyard; between Cottage City and Vi yard Haven; the bar across the north end of the pond is broken in several pla so that the pond is tidal. Marthas Vineyard sheet.

Landham Brook.—Middlesex County; rises about 1½ miles northwest of Frami ham Center, at altitude about 260 feet above sea level; flows eastward 1½ mi then generally northward 2½ miles to its junction with Hop Brook to form W Brook (tributary through Sudbury River to Concord River and thus to the Me mack) on the south slope of Green Hill near South Sudbury; swampy near mouth; head of stream called Hop Brook on the map. Framingham sheet.

Lane Pond.—Worcester County; one-half mile east of Turkey Hill, near the div between waters flowing to the Nashua (and thus to the Merrimack through Shi Reservoir) and Mulpus Brook. Groton sheet.

Larkum Pond.—Berkshire County; town of Otis; just north of the western ar Otis Reservoir; outlet, a stream one-eighth mile flowing southwesterly into stream connecting Otis Reservoir with the head of Farmington River (tribut to the Connecticut); small. Sandisfield sheet.

Larned Pond.—Worcester County; town of Dudley; inflowing stream drains a num of small ponds including Hayden Pond; outlet through Merino Pond to Fre River (tributary through Quinebaug River to Shetucket River and thus thro Thames River to Long Island Sound). Webster sheet.

Laurel Lake.—Berkshire County; towns of Lenox and Lee; outlet, a stream a long flowing southeastward into Housatonic River at Lee. Pittsfield sheet.

Lawrence Brook.—Cheshire County, N. H., Worcester County, Mass.; formed in town of Fitzwilliam, N. H., by the union of streams flowing from Little Mon nock Mountain and The Pinnacle; flows southward (as Kemp Brook) to Mea Pond, from which it emerges as Lawrence Brook and flows southward and sou westward to its junction with the East Branch of Tully River (tributary thro Tully River to Millers River and thus to the Connecticut) in the northwest part of the town of Royalston; length to head of Kemp Brook, 13 miles; princ tributary in Massachusetts, Beaver Brook. Monadnock and Winchendon she

Lawrence Brook.—Middlesex County; rises 5 miles northwest of Lowell at altit 320 feet above sea level; flows southwestward 2½ miles into Merrimack Ri principal tributary, a stream from Tyngs Pond. Lowell sheet.

Lawrence Pond.—Barnstable County; one of a group of ponds north of the villag Farmersville. Barnstable sheet.

Lead Mine Brook.—Worcester County; rises on the west slope of Lead Mine Mo tain; flows southwesterly through Lead Mine Pond into Mashapaug Pond in northeastern part of Union township, Conn.; the outlet of Mashapaug Pond stream flowing northwestward into Hamilton Reservoir (outlet through Holl Pond to Mill Brook and thus through Quinebaug, Shetucket, and Thames ri to Long Island Sound) in the southeastern part of the town of Holland, Hamp County. Brookfield sheet.

County; on the southwest slope of Lead Mine Mountain; o Mashapaug Pond (in Connecticut), thence northward ir to Holland Pond and Mill Brook to Quinebaug River ket River to Thames River and thus to Long Island t.

County; just north of South Framingham, one-half mile er (tributary through Concord River to the Merrimack); evel. Framingham sheet.

County; town of Southbridge; rises in the northwestern dstock, Windham County, Conn.; flows southeastward ponds about 2 miles, thence northeastward 7 miles to its River (tributary through Shetucket River to Thames sland Sound) at the village of Sandersville. Brookfield

unty; town of Plymouth; 1½ miles west of the city of Plymouth sheet.

ty; town of Mount Washington; outlet, Lee Pond Brook utary through Rocliff Jansen Kill to the Hudson); very

re County; town of Mount Washington; rises in Lee Pond; miles into Bashbish Brook (tributary through Rocliff on). Sheffield sheet.

ty; a tidal channel from Mount Hope Bay extending from all River sheet.

th County; town of Rochester; inlets, East and West ver, which unite at the head of the pond; outlet, Sippicon iver and thus to Buzzards Bay. Middleboro and New

unty; town of Swansea; a stream about 2½ miles long flow- Lees River (tributary to Mount Hope Bay and thus to wansea. Taunton and Fall River sheets.

County; 1½ miles north of Hyannis. Barnstable sheet.

County; town of Yarmouth; in the marsh west of the mouth utary to Nantucket Sound). Yarmouth sheet.

ounty; a small pond 1½ miles northeast of South Yarmouth; Pond by a marsh. Yarmouth sheet.

ounty; town of Barnstable; a small pond lying immediately ny Railroad track. Barnstable sheet.

unty; town of Northfield; a small pond connected by a am with Bennett Brook (tributary to Connecticut River).

nty; town of Cohasset; outlet, a very short stream flowing d Brook, which discharges into the ocean through Cohasset eet.

mpden County; town of Brimfield; outlet, a stream 2 miles then south into Quinebaug River (tributary through She- nes River and thus to Long Island Sound) at the village of okfield sheet.

—Worcester County; one-half mile north of Chauncey Pond, nected by Stirrup Brook; outlet, Stirrup Brook (tributary er to the Concord and thus to the Merrimack) through Bart- bout 270 feet. Marlboro sheet.

Little Clear Pond.—Plymouth County; town of Plymouth; a small pond one- mile northeast of East Carver; east of and very near to Darby Pond. Plymo sheet.

Little Cliff Pond.—Barnstable County; 1¼ miles west of South Orleans; a m connects the west end of the pond with Cliff Pond and Long Pond. Wellf sheet.

Little Creek.—Plymouth County; town of Marshfield; rises near Marshfield Ce station; flows northward and northeastward into the tidal marsh through wl North River discharges into the bay; about 2 miles long. Duxbury sheet.

Little Creek Pond.—Plymouth County; town of Duxbury; near head of Sc River. Duxbury sheet.

Little Fivemile Pond.—Plymouth County; town of Plymouth; one of a group of s ponds in the southern part of the township west of Agawam River. Plymc sheet.

Little Herring Pond.—Plymouth County; southeastern part of town of Plymo outlet, Monument River through Great Herring Pond to Buzzards Bay; abo mile long; the stream connecting Little Herring with Great Herring Pond is al one-fourth mile long. Plymouth sheet.

Little Island Pond.—Plymouth County; town of Plymouth; one-fourth mile so west of Beaver Dam Pond, into which it discharges by a northeastward flov stream. Plymouth sheet.

Little Mioxes Pond.—Nantucket County; Nantucket Island; one-half mile so east of Great Mioxes Pond; one of the numerous elongated ponds on the sc shore of the island; separated from the ocean by a barrier beach. Nantucket sh

Little Pond.—Barnstable County; town of Falmouth; a baylike pond connected Vineyard Sound by a narrow channel; one-half mile east of Falmouth Heig Falmouth sheet.

Little Pond.—Middlesex County; a short distance west of Somerville; inlets, W Brook from the west and a small stream from Spy Pond to the north; natural let, Little River to Alewife Brook (tributary to Mystic River); formerly pa the reservoir system of Boston and vicinity. Boston sheet.

Little Pond.—Norfolk County; west of South Braintree; outlet, a stream one- mile long flowing from the southwest end of southeastward into Weymouth River. Dedham sheet.

Little Pond.—Plymouth County; town of Plymouth; outlet, a stream one-half long flowing southwestward into Billington Sea; outlet, Town Brook to Plymo Harbor. Plymouth sheet.

Little Pond.—Worcester County; a small pond 2 miles northwest of Hudson, at tude 320 feet above sea level; outlet, a small stream flowing southward into a m larger stream (unnamed on the map), which takes a southeasterly course, pa through a pond at Hudson, and discharges into Assabet River (tributary thro Concord River to the Merrimack). Marlboro sheet.

Little Pond.—Worcester County; town of Mendon; an expansion of Meadow Br which flows through it to West River (tributary to Blackstone River and t through Seekonk and Providence rivers to Narragansett Bay). Blackstone sh

Little Pudding Brook.—Plymouth County; town of Pembroke; a stream abo mile long flowing northwestward into Herring Brook (tributary to North Riv Abington sheet.

Little Quittacas Pond.—Plymouth County; a pond one mile long by three-fou mile wide lying one-eighth mile west of the southern half of Great Quittacas Po with which it is connected by a short eastward flowing stream; natural outle the Quittacas ponds, Mattapoisett River; the ponds are used by the city of Bedford as a source of municipal water supply. Middleboro sheet.

y; a tidal channel in the marsh one-half mile east of
n Dartmouth; connected with Buzzards Bay. New

; rises about one-half mile west of Newburyport, at
e sea level; flows generally southeastward 5½ miles into
Plum Island River and the Atlantic Ocean) near New-
yport sheet.

; rises in a swamp about one-half mile south of West
d one-half mile, then generally eastward 1½ miles to its
r; just east of West Gloucester it terminates in a tide-
r sheet.

unty; formed in the town of Worthington by the junc-
reams; Wards stream, the continuation of Little River,
orthington Corners; flows southeastward 3 miles, then
gville, where it receives Watts stream; from Ringville
sterly 5½ miles to its junction with Westfield River
ut); length to head of Wards stream, 10 miles. Ches-

County, N. H., Essex County, Mass.; rises in the town
ham County, N. H., about 280 feet above sea level;
out 1½ miles it takes a southeastward course for about
ard 3 miles into Essex County, Mass., where it resumes
or 3½ miles and discharges into Merrimack River at
ary in Massachusetts, Fishing River. Haverhill sheet.

nty; towns of Charlton and Oxford; rises about 3 miles
ows southeastward to a point 1½ miles below Millward,
Slaters Reservoir to Buffumville, then eastward into
hrough Quinebaug River to Shetucket River and thus
Long Island Sound); length, about 10 miles. The
nber of small ponds and receives the drainage from a
luding Gore Pond, Pierpoint Meadow Pond, and South
ster sheet.

—Plymouth County; town of Pembroke; one-half mile
ttom Pond, into which it discharges by a northward
sheet.

ble County; town of Yarmouth; 1½ miles northeast of
flowing southwest and south into Lewis Bay on Nan-
sheet.

th County; town of Plymouth; one-fourth mile south
-fourths mile east of White Island Pond. Plymouth

uth County; town of Kingston; north of Monks Hill;
Smelt Pond; outlet, Smelt Brook to Jones River (tribu-
y to Massachusetts Bay). Plymouth sheet.

uth County; town of Plymouth; north of Great South
ugh Eel River to Plymouth Harbor), with which it is
ward flowing stream. Used as part of water supply of
outh sheet.

orcester County; one-fourth mile northwest of Spec-
discharges and which has outlet to North Branch of
hrough Nashua River to the Merrimack). Groton sheet.

Locke Brook.—Hillsboro County, N. H., Middlesex County, Mass.; rises in I Pond in the southeastern part of the town of New Ipswich, Hillsboro Cou N. H., at altitude about 1,000 feet above sea level; flows southeastward abo miles into Ash Swamp, which is drained through Squannacook River to Na River and thus to the Merrimack. Fitchburg sheet.

Lock Pond.—Franklin County; town of Shutesbury; east of Lock Village; thre flowing streams; outlet, a stream 2 miles long flowing westward 1 mile and so westward 1 mile into Saw Mill River (tributary to the Connecticut). War and Belchertown sheets.

Locust Pond.—Middlesex County; northwest base of Locust Hill, 1 mile north of Tyngsboro; inflowing stream, about 1½ miles long; outlet, a stream half mile long flowing northeastward into Merrimack River 1 mile north of Ty boro. Lowell sheet.

Long Creek.—Barnstable County; a tidal channel in the marsh back of Spring Beach. Barnstable sheet.

Long Duck Pond.—Plymouth County; town of Plymouth; one-half mile west of tle Herring Pond. Plymouth sheet.

Long Meadow Brook.—Hampden County; rises in a small pond in the southern of the town of Longmeadow; flows northward 1 mile, then irregularly westwa miles into Connecticut River. Springfield sheet.

Long Meadow Brook.—Worcester County; town of Rutland; rises in Long I near White Hall; flows northwestward 2½ miles into Ware River (tributary thro Chicopee River to the Connecticut), 2½ miles southwest of North Rutland. cester sheet.

Long Plain Brook.—Franklin and Hampshire counties; rises in the town of Leve on the southeast slope of Mount Toby; flows in general southwestward to necticut River; length, 7 miles. Northampton sheet.

Long Pond.—Barnstable County; between Brewster and Harwich; outlet, thro Herring River to Nantucket Sound; 2½ miles long and 1 mile in maximum wi altitude, about 20 feet above sea level. Yarmouth sheet.

Long Pond.—Barnstable County; half a mile southwest of Yarmouth Port Dennis Pond. Barnstable sheet.

Long Pond.—Barnstable County; southeast of Cliff Pond, with which its lower e connected by a marsh. Wellfleet sheet.

Long Pond.—Barnstable County; town of Barnstable; one-half mile south of C Pond. Barnstable sheet.

Long Pond.—Barnstable County; town of Barnstable; 1½ miles west of Cotuit Po Barnstable sheet.

Long Pond.—Barnstable County; town of Falmouth; 1½ miles north of the cit Falmouth; used as municipal supply by Falmouth. Falmouth sheet.

Long Pond.—Barnstable County; town of Wellfleet; a mile northeast of the villa Wellfleet; connected with Great Pond by a short stream. Wellfleet sheet.

Long Pond.—Barnstable County; town of Yarmouth; three-fourths mile north of South Yarmouth; a narrow pond about a mile long. Yarmouth sheet.

Long Pond.—Berkshire County; northwestern part of the town of Great Barrin natural outlet, Long Pond Brook (tributary through Seekonk Brook to G River and thus to the Housatonic). The water is used for the municipal su of the village of Housatonic in the town of Great Barrington. Sheffield she

Long Pond.—Bristol and Plymouth counties; town of Lakeville; principal in Fall Brook (head of Namasket River) and stream from Elders Pond; outl Assawompsett Pond and thus through Namasket River and Taunton Riv Narragansett Bay. The pond is about 3 miles long, more than one-half mi maximum width, and contains several small islands. Middleboro sheet.

ɜ County; western part of the town of Great Barrington;
ɜoutheastward 1 mile, then southwestward 1 mile into
through Green River to the Housatonic). Sheffield

'; town of Erving; a small pond discharging by an east-
arris Pond on Moss Brook (tributary through Millers
Warwick sheet.

ıy; town of Blandford; a short distance east of the Berk-
ıundary; outlet, a stream flowing into Pebble Brook
ɜervoir on Westfield Little River) at North Blandford.
. Sandsfield sheet.

y, N. H., Middlesex County, Mass.; about two-thirds
ıusetts; outlet through Double Brook to Beaver Brook
. Lowell sheet.

ty; 1 mile south of Littleton Common on the south slope
itude 260 feet above sea level; inlet, a stream one-half
ıe map; outlet a stream, also unnamed on the map,
ɜ, through Fort Pond, into a stream called on the map
ınnamed stream is considered the head of Fort Pond
r area than does the tributary called on the map Fort
Framingham sheets.

ıty; 1 mile southwest of Tewksbury Center, at altitude
level; outlet, a short stream about one-half mile long
ıtent Brook (tributary through Shawsheen River to the
t three-fourths mile; width, about one-fourth mile.
ɔts.

ty; 2 miles northeast of Ayer; between Snake and Rocky
ım; marshy; outflowing stream passes through Sandy
ɔf Ayer and thus through Nonacoicus Brook to Nashua
errimack); altitude, 230 feet above sea level. Groton

ınty; Nantucket Island; western end; a narrow pond
a mile of Nantucket Sound on the north and one-eighth
e south. Nantucket sheet.

ıty; town of Plymouth; one of a group of small ponds in
ıe township. Plymouth sheet.

ıty; town of Plymouth; 3 miles south of Telegraph Hill;
ls, one on the north and the other on the south; 1 mile

ıty; town of Rochester; less than one-eighth mile south-
Middleboro sheet.

ıty; two small ponds connected by a short stream; the
town of Plymouth; the southerly in Wareham; neither
ng, and the name may be applied to either or both.

ty; principal inlets, streams from Baker Pond and Alum
ıe-eighth mile long flowing southward into Quinebaug
Shetucket River to Thames River and thus to Long
le west of Fiskdale. The pond is about 2 miles long and
imum width. Brookfield sheet.

ıty; town of Royalston; on East Branch of Tully River
River to Millers River and thus to the Connecticut).
Branch of Tully River the Pond receives Boyce Brook.

Long Pond.—Worcester county; town of Rutland; west of the village of West Ru inlet, stream from Demond Pond; outlet, Long Meadow Brook to Ware (tributary through Chicopee River to the Connecticut). The pond is al miles long and one-eighth mile wide. Worcester sheet.

Loon Pond.—Hampden County; a small pond 1½ miles south of Chicopee (tributary to the Connecticut). Palmer and Springfield sheets.

Loon Pond.—Plymouth County; town of Lakeville; one-fourth mile northe Elders Pond. Middleboro sheet.

Lout Pond.—Plymouth County; town of Plymouth; one-fourth mile east of Billi Sea. Plymouth sheet.

Love Creek.—Barnstable County; town of Yarmouth; a tidal channel in the north of Yarmouth Port. Barnstable and Yarmouth sheets.

Lovells Pond.—Barnstable County; town of Barnstable; one-fourth mile e Santuit Pond; outlet, a stream 2 miles long flowing southeastward into Oste Harbor, Nantucket Sound. Barnstable sheet.

Lower Massapoag Pond. *See* Massapoag ponds.

Lower Pond.—Hampshire County; one of a group of three ponds in the to Belchertown drained by Bachelor Brook (tributary to the Connect Belchertown sheet.

Lubber Brook.—Middlesex County; rises 1½ miles southwest of Wilmington C at altitude 80 feet above sea level; flows generally westward about 1½ northeastward 3½ miles, then southeastward 1½ miles into Ipswich River. rence sheet.

Lulu Brook.—Berkshire County; rises in the eastern part of the town of Ha flows southeastward across the southwestern corner of Lanesboro into Pitt and enters the northern arm of Lake Onota (outlet Onota Brook to west b of Housatonic River and thus to the Housatonic); length, 3 miles. Berli Pittsfield sheets.

Lynde Brook.—Worcester County; rises on the southwest slope of Asnebumskit flows southeastward and joins Kettle Brook (tributary through Blackstone to Seekonk River and thus through Providence River to Narragansett Ba the pond at Cherry Valley; passes through Lynde Brook Reservoir. Wor and Webster sheets.

Lynde Brook Reservoir.—Worcester County; north of Cherry Valley; inle outlet, Lynde Brook (tributary through Kettle Brook to Blackstone Rive thus through Seekonk and Providence rivers to Narragansett Bay). Wor sheet.

Lyons Pond.—Hampden County; town of Ludlow; 1½ miles north of Ludlow C a very small pond on a tributary of Higher Brook (tributary through Chi River to the Connecticut). Palmer sheet.

Madequecham Pond.—Nantucket County; Nantucket Island; south shore; rated from the ocean by a narrow beach. Nantucket sheet.

Malden Brook.—Worcester County; rises about 1¼ miles northwest of Summit st on the Fitchburg & Worcester Railroad, at altitude about 820 feet above sea flows somewhat east of north into upper end of Wachusett Reservoir; length, 5 miles. Worcester sheet.

Malden River.—Middlesex County; rises just north of Melrose and flows eas about 1 mile, then southward about 9 miles into Mystic River; drains C Pond at Melrose. Boston sheet.

Manchaug Pond.—Worcester County; northwest of the village of Manchaug; and outlet, Mumford River (tributary to Blackstone River, and thus th Seekonk and Providence rivers to Narragansett Bay); nearly 2 miles long; half mile wide. Webster sheet.

pshire County; head of Southwest Branch of main Manhan
the Connecticut). Chesterfield and Granville sheets.

shire County; rises on the west slope of Mount Pisgah; flows
iles, thence northeastward 10 miles to its junction with the
headwater stream, called Manhan Brook, joins the Southwest
r is called above Russellville, in the western part of the town
rincipal tributary of the river is the North Branch, which
Westhampton, Northampton, and a small area in Southampton.
ampton, Granville, and Springfield sheets.

BRANCH.—Rises about 3 miles northwest of Hanging Moun-
stward 9 miles into Manhan River (tributary to the Connecti-
of Easthampton; principal tributaries, North Brook (consid-
e stream) and Sodden Brook. Chesterfield and Northampton

HWEST BRANCH.—*See* Manhan River.

kshire County; town of Florida; a stream 2 miles long, flowing
Cold River (tributary through Deerfield River to the Con-
mile below the mouth of Tanner Brook. Greylock and Hawley

rkshire County; a small pond northwest of the village of Great
, a stream one-half mile long flowing eastward into Housatonic
sheet.

OK.—Middlesex County; rises about 1½ miles west of North
140 feet above sea level; flows eastward 1 mile, then northward
ich River. Lawrence sheet.

.—Plymouth County; rises in the southern part of the town of
southward 3 miles and discharges into the pond which is an
am River (tributary through Wareham River to Buzzards Bay)
eham. Plymouth sheet.

nouth County; town of Hanson; outlet, a stream about one-half
southeastward into Indian Head Pond (outlet, Indian Head
ead River and thus through North River to Massachusetts Bay).

table County; town of Falmouth; about halfway between East
th. Falmouth sheet.

kshire County; rises in the town of Lenox a mile southeast of
; flows southward 2½ miles, then westward one-half mile into
l, from which it flows southward to Housatonic River; length
ge Bowl, about 3 miles; to extreme head, 7 miles. Pittsfield

shire County; town of Egremont; one inlet; outlet, a stream a
g southeastward into Karner Brook (head of Hubbard Brook,
ry through Schenob Brook to the Housatonic). Sheffield sheet.

dlesex County; 1 mile northeast of Groton between Chestnut
Hill; outlet, Martins Pond Brook to Cow Pond Brook and thus
ag ponds and Salmon Brook to the Merrimack; altitude, 310
vel. Groton sheet.

iddlesex County; rises in Martins Pond, 2½ miles northwest of
at altitude 80 feet above sea level; flows southwestward 1 mile,
astward 2 miles into Ipswich River. Lawrence sheet.

OK.—Middlesex County; rises in Martin Pond at altitude 310 feet
flows southeastward about 2½ miles into Cow Pond Brook, which
gh Massapoag ponds to Salmon Brook and thus to the Merrimack
eadows). Groton sheet.

Martins Pond.—Middlesex and Essex counties; in a swamp 2½ miles northw Reading; inlet, Skug River; outlet, Martins Brook to Ipswich River; altitu feet above sea level; length, one-half mile; maximum width, one-fourth Lawrence sheet.

Marys Pond.—Plymouth County; town of Rochester; one-half mile east of Leo Pond on Sippicon River. Middleboro sheet.

Mashpee Pond.—Barnstable County; at head of Mashpee River (tributary to tucket Sound); a large pond of very irregular outline; the upper arm of the is called Wakeby Pond. Barnstable sheet.

Mashpee River.—Barnstable County; rises in Mashpee Pond; flows southwar southeastward into Poponesset Bay through which it is connected with Nant Sound; length to head of Wakeby Pond (the northern arm of Mashpee P about 8 miles. Barnstable sheet.

Mason Brook.—Hillsboro County, N. H., Middlesex County, Mass.; rises i western part of the town of Mason in Hillsboro County, N. H., at altitude 940 feet above sea level; flows somewhat east of south about 6 miles into Swamp, which is drained through Squannacook River to Nashua River and to the Merrimack. Peterboro and Fitchburg sheets.

Massapoag Pond.—Norfolk County; town of Sharon; several small infl streams; outlet, Canton River to Neponset River; altitude, about 260 length, about 1 mile; maximum width, about one-half mile. Dedham shee

Massapoag Ponds.—Middlesex County; about 3 miles northeast of Groton; ponds connected by streams about one-fourth mile long; inlet, Cow Pond (the head of Salmon Brook); outlet, Salmon Brook to Merrimack River. upper pond lies just below the 200-foot contour. The lower pond is just abov 160-foot contour. From the head of the upper pond to the outlet of the pond the distance is about 2½ miles. The middle pond is the longest and is Massapoag Pond. Groton and Lowell sheets.

Massapoag Pond.—Worcester County; southeast slope of Nichols Hill, 1 mile of Shirley reservoir; inlet, a stream from Unchechewhaton Pond; outl stream about 1½ miles long flowing northeastward into Catacoonamug (tributary through Shirley reservoir) to Nashua River and thus to the Merri Groton sheet.

Matfield River.—Norfolk and Plymouth counties; rises in the swamp northe Stoughton; flows southeastward about 15 miles and unites with Town Ri form Taunton River; called Salisbury Plain River and Saulsbury Brook junction with Beaver Brook; principal tributaries, Beaver Brook, Me Brook, and Satucket River. Abington and Dedham sheets.

Mattapoisett River.—Plymouth County; the natural outlet of Great Qui Pond; from this pond the stream flows southeastward to Snipatuit Pond, southward to Mattapoisett Harbor where it enters Buzzards Bay; length, 12 miles. Great and Little Quittacas ponds are used by the city of New Be as a source of municipal water supply. Middleboro and New Bedford shee

Maxey Pond.—Nantucket County; Nantucket Island; one-half mile north of mock Pond; 1½ miles west of the city of Nantucket; small. Nantucket she

Maynard Brook.—Worcester County; town of Oakham; rises 1 mile southw the village of Oakham; flows southeastward 2½ miles into Fivemile River (tary through East Brookfield River to Quaboag River and thus through Chi River to the Connecticut) one-half mile north of Brooks Pond. Barre shee

McCard Brook.—Franklin County; rises on the southeast slope of Ball Mou flows west of south 2½ miles into Mill Brook (tributary through Green Ri Deerfield River and thus to the Connecticut). Greenfield sheet.

ol County; rises 2 miles east of North Rehoboth; flows east of
ook (tributary through Threemile River to Taunton River
nsett Bay); length, 2½ miles. Taunton sheet.

pshire County; rises on Walnut Hill in the town of Plain-
rd 5 miles to Cummington, where it enters Westfield River
nnecticut). Hawley and Chesterfield sheets.

dlesex County; rises on northwest slope of Snake Meadow
0 feet above sea level; flows irregularly northeastward into
through Keyes Brook to Stony Brook and thus to the Merri-
; 2 miles. Lowell sheet.

mouth County; town of East Bridgewater; rises about 2 miles
, flows southwesterly 3½ miles to its junction with Matfield
rough Taunton River to Narragansett Bay); flows through sev-
Abington sheet.

rcester County; rises in Nipmuck Pond a mile southwest of the
flows southwestward 2 miles, then westward about a mile into
ary to Blackstone River and thus through Seekonk and Provi-
rragansett Bay); tributary, Wigwam Brook. Blackstone sheet.

rcester County; 2 miles southwest of New Braintree; a stretch
butary through Wickaboag Pond to Quaboag River and thus
River to the Connecticut) between the ponds into which Sucker
nd the head of Mill Brook; 1½ miles long; Barre sheet.

es County; Marthas Vineyard; north of Cottage City; sepa-
nd by a narrow beach. Marthas Vineyard sheet.

D.—Worcester County; a pond about a mile long, which lies
ster and discharges by a stream that flows southeastward into
tary to Whitman River, which discharges through North Branch
o Nashua River and thus to the Merrimack; altitude, 1,010 feet
all of outflowing stream, 140 feet. Fitchburg sheet.

rkshire County; a mile south of Pittsfield; principal inlet,
; outlet, Wanpenum Brook to Housatonic River; small. Pitts-

ukes County; Marthas Vineyard; Gay Head; the water of Vine-
rs the pond at its northeast end; a southern arm of the pond
tends within an eighth of a mile of the ocean at the south. The
re than a mile long (northeast-southwest) and about a mile wide.

rcester County; town of Dudley; inlets, streams from Larned
Pond; outlet, a stream one-eighth mile long flowing eastward into
ributary through Quinebaug River to Shetucket River and thus
River to Long Island Sound). Webster sheet.

—New Hampshire, Massachusetts; formed near Franklin, N. H.,
igewasset and Winnepesaukee rivers; Pemigewasset River, con-
l of the main stream, rises in Profile Lake near Franklin, N. H.,
60 miles north of Franklin and less than 10 miles from Mount
ltitude approximately 2,000 feet above sea level. Below Frank-
ck flows southward about 60 miles, crosses into Massachusetts,
y of Lowell turns abruptly, flows northeastward about 40 miles to
here it enters the ocean. Total length to head of Pemigewasset
5 miles; drainage area, 5,010 square miles, of which about 1,200
in Massachusetts, 211 square miles lying in the Nashua, Sudbury,
ituate drainage areas from which water is permanently diverted
f Boston and vicinity.

Important tributaries of the Merrimack, other than headwater stream
Contoocook, Suncook, Piscataquog, Souhegan, and Nashua rivers. Of
only the Nashua lies principally in Massachusetts.

Elevation of river at Franklin, about 270 feet. Upper portion of ba
rough and mountainous and very largely in forests; below Franklin, co
drained is rolling and much of it is farm land.

The river flows in reaches of moderate slope separated by fall ove
ledges. It is navigable as far as Haverhill, and for small boats as far as Law

Mean annual rainfall in basin, about 42 inches, ranging from about 46 i
at Lowell to 38 inches at Plymouth, but it is probably much greater in the
tainous region near the head of the Pemigewasset than elsewhere in the are

The combined area of lakes and ponds in the drainage basin is approxi
183 square miles, of which about 105 square miles is contained in Lake Win
saukee. The storage on many of the lakes is controlled by users of water
on the river and greatly improves the low-water flow. In a general way the
favorable storage and power sites on the Merrimack are being utilized, but
tributaries, especially on the Pemigewasset and its tributaries, there is a
amount of unutilized fall. Gaging stations: Pemigewasset River at Plym
N. H., 1886–1915; Merrimack River at Franklin Junction, N. H., 1903–1915
vins Falls, N. H., 1904–1915; Lowell, Mass., 1848–1860, 1865–1915, and Law
Mass., 1880–1915. Authority: Water-Supply Papers of U. S. Geological S
Manchester, Lowell, Lawrence, Haverhill, and Newburyport sheets. *Se*
pages 192–282 of this report.

Miacomet Pond.—Nantucket County; Nantucket Island; one of the nu
elongated ponds on the south shore of the island; about a mile long; sep
from the ocean by a barrier beach. Nantucket sheet.

Micajah Pond.—Plymouth County; town of Plymouth; three-fourths mile so
the west end of Billington Sea. Plymouth sheet.

Middle Pond.—Hampshire County; one of a group of three ponds in the to
Belchertown drained by Bachelor Brook (tributary to the Connecticut).
chertown sheet.

Mile Brook.—Essex County; formed by the junction of Howlett and Pye b
about one-half mile north of Topsfield; flows southeastward 2½ miles into Ip
River; swampy throughout much of its course. Salem sheet.

Mile Brook.—Plymouth County; town of Kingston; a stream about a mile
flowing southward into the north end of Blackwater Pond on Halls Brook (
tary through Jones River to Kingston Bay, a branch of Massachusetts
Duxbury sheet.

Miles River.—Essex County; rises in a swamp about 3 miles northeast of Be
takes an irregular course westward for 4 miles, then flows generally east of
for 7 miles into Ipswich River about 1 mile southwest of Ipswich; throug
small tributaries it drains Wenham Lake and Beaver Pond. Salem sheet.

Mill Brook.—Bristol County; town of Fall River; rises north of Copecut Hill
west of north into Assonet River (tributary through Taunton River to
gansett Bay) below the village of Assonet; length, about 5 miles; tidal in
course. Taunton and Fall River sheets.

Mill Brook.—Franklin County; rises 1½ miles southwest of North Heath;
southwesterly 4½ miles into Deerfield River (tributary to the Connectic
Charlemont. Hawley sheet.

Mill Brook.—Franklin County; rises southeast of Alexander Hill in the to
Northfield; flows eastward and northeastward about 2 miles, northwestw
miles, southwestward 2 miles, then again northwestward 1½ miles to its ju
with Connecticut River at Northfield; fall, 1,000 feet, of which 500 feet
in a little more than 2 miles as the stream encircles the base of Hemlock Mou
Warwick sheet.

ounty; rises southeast of Frizzell Hill, in the town of Leyden;
miles, then southwesterly 5 miles to its junction with Green
igh Deerfield River to the Connecticut) north of Green-
ary, McCard Brook. Greenfield sheet.
ounty; town of Monroe. *See* Dunbar Brook.
County; town of Brimfield. *See* Quinebaug River.
County; rises in the northern part of the town of Plainfield;
f south 6 miles into Westfield River (tributary to the Con-
nd Chesterfield sheets.
e County; town of Goshen; the stream flowing from the
shen and forming the head of West Branch of Mill River
necticut). Chesterfield sheet.
County; rises (as Sucker Brook) in the town of New Brain-
ill; flows southwestward 4 miles into a small pond in North
orthwestward 1½ miles (as Meadow Brook), thence south-
boag Pond to Quaboag River (tributary through Chicopee
cticut); distance along stream from head of Sucker Brook
) miles. Barre and Brookfield sheets.
r County; rises 1 mile northwest of Summit Station; flows
a mile, thence southward through the city of Worcester
r (tributary through Seekonk River to Providence River;
nsett Bay); principal tributary, stream from North Pond-
al small ponds. Worcester sheet.
r County; town of Rutland; rises in Moulton Pond north of
ws southwestward 1 mile, then northwestward 2 miles into
(tributary through Ware River to Chicopee River and thus
. Worcester sheet.
er County; town of Webster; rises in Lake Chaugunagunga
restward into French River (tributary to Quinebaug River
Shetucket and Thames rivers to Long Island Sound) near
it a mile long. Webster sheet.
le County; rises in Mill Pond at Sandwich; flows northward
gh the tidal marsh east of Sandwich and discharges into Cape
ble sheet.
er County; a northwestward flowing stream discharging into
utary to Connecticut River) at Athol; drains several ponds
including the reservoir southwest of Ward Hill. Winchendon

pden County; town of Agawam; a stream less than a mile
iward into Westfield River (tributary to the Connecticut).

.—Plymouth County; a stream about 2 miles long flowing
ack Brook at the northern end of the swamp through which
on its way to Great Quittacas Pond (natural outlet, Matta-
izzards Bay). Middleboro sheet.
cester and Franklin counties; formed in the town of Ash-
nion of Bear Meadow and Bluefield brooks. Bluefield Brook,
larger area and is therefore considered the continuation of
he southwestern part of the town of New Ipswich, Hillsborough
a small pond on the south slope of Barrett Mountain, and flows
miles to its junction with Bear Meadow Brook; from this point
of the Millers is southwesterly and westerly to Millers Falls,
rply and flows northward to its junction with the Connecticut;
iles; drainage area, 394 square miles, of which 313 square miles

is in Massachusetts and 81 square miles in New Hampshire; principal tribu from the north, Priest Brook, Tully River, Orcutt, Moss, and Keyup b from the south, Otter River, Beaver Brook, Mill Creek, and Whetstone, O and Wickett brooks. The basin contains many ponds, the largest being Monomonac; precipitation throughout the basin ranges from 45 inches i upper to 40 inches in the lower part; water powers fairly well developed, cially between Athol and Millers Falls. Gaging stations at Wendell and E Fitchburg, Winchendon, and Warwick sheets. *See also* pages 82–88 of this r

Millham Brook.—Middlesex County; rises in Williams Pond just west of Ma at altitude about 420 feet above sea level; flows generally westward 2 mile Assabet River (tributary through Concord River to the Merrimack). Ma sheet.

Mill Pond.—Barnstable County; 1½ miles southeast of Yarmouth village; infl stream considered the head of Bass River; outlet, Bass River (through F Pond) into Nantucket Sound; about one-half mile long. Yarmouth sheet.

Mill Pond.—Barnstable County; town of Bourne; north of Monument Beach nected through Back River with Phinneys Harbor, Buzzards Bay. Fal sheet.

Mill Pond.—Barnstable County; town of Chatham; outlet, Mitchell River to Harbor and Nantucket Sound. Chatham sheet.

Mill Pond.—Barnstable County; town of Sandwich; outlet, Mill Creek to Cap Bay. Barnstable sheet.

Mill Pond.—Bristol County; an expansion of Acushnet River (tributary to Bedford Harbor) about a mile north of Acushnet. New Bedford sheet.

Mill Pond.—Middlesex County; on Beaver Brook (outlet, through Forge to Stony Brook and thus to the Merrimack) near Littleton station. Groto Lowell sheets.

Mill Pond.—Plymouth County; town of Plymouth; on Eel River (tribut Plymouth Harbor) about 1½ miles east of Great South Pond. Plymouth

Mill Ponds.—Barnstable County; a group of ponds south of West Brewster; Herring River into Cape Cod Bay. The largest of the ponds is about a mil and one-half mile wide. Yarmouth sheet.

Mill River.—Bristol County; formed by a number of streams which drain p the towns of Sharon and Foxboro in Norfolk County, and Easton and Ma in Bristol County; Canoe River, the stream which drains the larger area therefore considered the continuation of Mill River, rises in a swamp a mile south of Massapoag Pond in Norfolk County and flows in a very irr but in general southeasterly course into Winneconnet Pond; from Winne Pond Mill River flows eastward to the southwestern end of the Great Cedar S then southward to its junction with Taunton River (tributary to Narrag Bay) at the city of Taunton; length to head of Canoe River, about 20 principal tributary, Mulberry Meadow Brook, which flows into Winne Pond. Called Pecuanticiot River in upper part of its course. Dedha Taunton sheets.

Mill River, East Branch.—Franklin and Hampshire counties; rises in the western part of the town of Conway; flows southward to Williamsburg, w unites with the West Branch to form Mill River (tributary to the Connec length, 7 miles; principal tributary, Bradford Branch. Chesterfield and ampton sheets.

Mill River.—Essex County; rises in a swamp one-half mile east of South G town, at altitude 80 feet above sea level; flows southeastward 1½ miles, generally northeastward about 8 miles into Parker River (tributary to Island River and thus to the Atlantic Ocean); swampy throughout most course; principal tributaries, Great Swamp, Bachelder, and Pasture b Called Mill Creek near its mouth. Salem and Newburyport sheets.

ty; rises one-half mile north of Gloucester; flows somewhat
e and forms a tidewater channel which flows northward
g Squam River at its mouth. Gloucester sheet.

nd Hampshire counties; rises 1½ miles northeast of Conway;
3 miles, then southward to its junction with the Connecti-
; principal tributaries, Bloody, Roaring, West, and Running
nfield and Northampton sheets.

County; formed by the junction of North and South branches,
to Water Shop Pond; the North Branch, considered the con-
r, rises in Ninemile Pond in the northern part of the town of
uthwestward 3½ miles, northwestward 3 miles, then to the
3 miles to the head of the northern arm of the pond; from
ows southwestward 1½ miles into Connecticut River. Palmer
ts.

re County; formed at Williamsburg by the union of its east
The West Branch, considered the continuation of the main
town of Goshen and flows southeastward; below the mouth of
e river continues to flow southeasterly to its junction with
the town of Northampton; length to head of West Branch,
incipal tributaries below East Branch, Wright River, and
er, and Roberts brooks.
low is sustained by two reservoirs about 9 miles from the
e upper reservoir is the smaller, flows 64 acres, and is fed partly
or two little brooks but mainly by spring rains and melting
reservoir flows 133 acres, it receives no stream except the one
pper reservoir, but fills regularly. Bed of stream composed
d gneiss; stream improved. *See* Water Power of the United
us, vol. 16, 1885, pp. 274 and 275, for description of physical
n and an account of the failure of the Williamsburg reservoir
eld and Northampton sheets.

ire and Franklin counties; formed near East Leverett by the
g and Pond brooks. Roaring Brook, which drains the larger
e considered the continuation of Mill River, rises 1 mile north
flows southwesterly to its point of junction with Pond Brook;
ill River flows southwestward to North Amherst, southward
of Agricultural College, thence in general westerly, though
ward curve, into Connecticut River at North Hadley; length
Brook, 13 miles. Belchertown and Northampton sheets.

ex and Worcester counties; rises about 2 miles south of Wood-
of Hopkinton; flows in general somewhat east of south to its
kstone River (tributary to Seekonk River and thus through
to Narragansett Bay) at Woonsocket, R. I.; length, 16 miles;
s, Muddy, Round Meadow, and Hop brooks; passes through
ackstone sheet.

County; rises in Great Pond 1 mile southwest of South Wey-
ward and northeastward into Whitman Pond (outlet Weymouth
sidered continuation of Weymouth Back River. Abington

ANCH.—Hampshire County; rises on the west slope of Wilbra-
ws southwestward 3 miles, west of north 2½ miles, southwest-
gain northwestward 1 mile to the head of the southern arm of
(outlet Mill River to Connecticut River). Palmer and Spring-

Mine Brook.—Hillsboro County, N. H., Middlesex County, Mass.; rises in H
N. H.; flows southward 2 miles into Nissitisset River (tributary through Na
River to the Merrimack) near North Village. Groton sheet.

Mine Brook.—Norfolk County; rises 1 mile east of Cedar Hill, at altitude 25
above sea level; flows southwestward about 3 miles, then southeastward 3
to its junction with Neponset River, in the town of Walpole. Franklins he

Mine Brook.—Norfolk County; rises about 4 miles southwest of Franklin, at
tude 280 feet above sea level; flows northward into Charles River (tributa
Boston Bay) at West Medway; length, about 9 miles; fall, about 100 feet; p
through Beaver Pond and a long narrow pond west of Franklin. Fra
sheet.

Mine Brook.—Worcester County; town of Webster; a stream 1½ miles long flo
southwestward into Sucker Brook (tributary to Lake Chaubunagungan
which discharges through Mill Brook to French River and thus through Q
baug River to Shetucket and Thames rivers and Long Island Sound). We
sheet.

Minechoag Pond.—Hampden County; a small pond 1 mile northeast of Lu
and three-fourths mile north of Chicopee River (tributary to the Connecti
Palmer sheet.

Mirey Brook.—Franklin County, Mass., Cheshire County, N. H.; formed on
north slope of Mount Grace, in the town of Warwick by the union of Mou
and Kidder brooks; Mountain Brook, which is considered the continuation o
main stream, rises on the east slope of Mount Grace and flows in general n
westward to its junction with Kidder Brook; below that junction Mirey B
flows northwestward to Winchester, where it enters Ashuelot River (tribu
to Connecticut River); length to extreme head of Mountain Brook, about 8 m
of which about 3 miles is in Massachusetts. Warwick and Keene sheets.

Miscoe Brook.—Worcester County; town of Grafton; the head of West River (t
tary to Blackstone River and thus through Seekonk and Providence rive
Narragansett Bay). Blackstone sheet.

Mitchell Brook.—Berkshire County; town of New Ashford; a stream 1½ miles
flowing westward into the East Branch of Green River (tributary through G
River to Hoosic River and thus to the Hudson) 1½ miles northeast of the villa
New Ashford. Greylock sheet.

Mitchell River.—Barnstable County; the channel connecting Mill Pond with
Harbor in the town of Chatham. Chatham sheet.

Moccasin Brook.—Worcester County; rises in the town of Phillipston, one-ei
mile west of the south end of Phillipston Pond; flows northwestward one-half
then southwesterly 5 miles into the East Branch of Swift River (tributary thr
Swift River to Ware River and thus through Chicopee River to the Connecti
Winchendon and Barre sheets.

Mohawk Brook.—Berkshire County; town of Stockbridge; rises in Mohawk La
mile northwest of Glendale; flows southward into Housatonic River; abou
miles long. Pittsfield sheet.

Mohawk Brook.—Franklin County; town of Sunderland; rises 3 miles south of M
Toby; flows southwestward into Dug Brook (tributary to the Connecticut); 3
long. Northampton sheet.

Mohawk Lake.—Berkshire County; western part of the town of Stockbridge; a
northwest of Glendale; outlet, Mohawk Brook to Housatonic River. Pitts
sheet.

Monomonac Lake.—Cheshire County, N. H., and Worcester County, Mass.; se
small inflowing streams; outlet, a stream flowing southwestward into Whi
Pond on Millers River (tributary to the Connecticut). The lake is very irre
in outline and contains a number of small islands; altitude, about 1,030 feet a

a outlet of lake and Whitney Pond, about 70 feet; approxi-
Fitchburg and Winchendon sheets.

rcester County; heads in a large reservoir about 3 miles
of Leominster; flows northeastward 2½ miles, southeastward
r, then very irregularly eastward about 2 miles into North
ver (tributary through Nashua River to the Merrimack). In
through several ponds. Fitchburg and Groton sheets.

nouth County; town of Halifax; a large pond almost bisected
ich is crossed by a road leading from Halifax to Bryantville.
he pond is fed by a stream from Stetson Pond; the western
n that rises near Bryantville. The discharge of the pond is
reat Cedar Swamp to Stump Pond, thence through a short
nd, and thus to Satucket River (tributary to Matfield River
unton River to Narragansett Bay). Abington sheet.

mouth and Barnstable counties; rises in Little Herring Pond
part of the town of Plymouth; flows southward through Great
urnedale, then southwestward into Buzzards Bay; length to
ring Pond, about 8 miles; fall below Little Herring Pond
mouth and Falmouth sheets.

ster County; rises at North Brookfield; flows southeastward 2½
ook (tributary through Quaboag River to Chicopee River and
ticut). Barre and Brookfield sheets.

n County; town of Warwick; 2 miles south of the village of
ace Brook, the head of Moss Brook; outlet, Moss Brook to
utary to the Connecticut). Warwick sheet.

shire County; a stream about 2 miles long flowing northward
(tributary to the Connecticut) in the southern part of the town
Springfield sheet.

ster County; rises in the town of Barre 3 miles northwest of the
ws somewhat west of south 8½ miles into Ware River (tributary
River to the Connecticut) at Old Furnace in the town of Hard-

—Franklin County; town of New Salem; rises on the south slope
ws southeastward 3½ miles into Hop Brook Pond (outlet Hop
ranch or head of Swift River, which is tributary through Ware
River and thus to the Connecticut). Warwick and Belcher-

Worcester County; town of Hubbardston; outlet, a stream one-
ing northwestward into the West Branch of Ware River (tribu-
River to Chicopee River and thus to the Connecticut); three-
one-fourth mile wide. Worcester sheet.

OK.—Hampden County; rises on the west slope of Bungy Hill,
ntgomery; flows somewhat east of south 7 miles to its junction
ver (tributary to the Connecticut) 2 miles northwest of the city
anville sheet.

ester County; town of Spencer; northeast of Spencer Center;
miles long flowing southwesterly into Sevenmile River (tribu-
Brookfield River to Quaboag River and thus through Chicopee
nnecticut). Worcester sheet.

outh County; town of Plymouth; 1½ miles southwest of Indian
sheet.

olk and Middlesex counties; inlets, streams from None Such and
outlet, a stream one-eighth mile long flowing eastward into
butary to Charles River). Framingham sheet.

Morton Pond.—Hampshire County; town of Ware; 2 miles northwest of Brim Hill; outlet, Beaver Brook to Ware River (tributary through Chicopee Riv the Connecticut). Belchertown sheet.

Mosquito Brook.—Essex County. *See* Fish Brook.

Mosquito Pond.—Plymouth County; town of Wareham; one-half mile west of Til Pond; outlet, a stream a mile long flowing southeastward into Wankinco I (tributary through Wareham River to Buzzards Bay) at the village of Tih Plymouth sheet.

Moss Brook.—Franklin County; rises on the south slope of Mount Grace; flows s eastward (as Grace Brook) to Lake Moore, thence in general somewhat w south to its junction with Millers River (tributary to the Connecticut) at We Depot; gaging station at Wendell Depot, 1909–10; length to head of Grace B 7 miles; principal tributary, Wilson Brook. Warwick sheet.

Mother Brook.—Norfolk and Suffolk counties; flows from Charles River th East Dedham and Hyde Park and joins Neponset River about 1½ miles belo Great Meadows. Mother Brook is legally entitled to one-third of the flow of Ch River, which at the point where the brook begins drains an area of 198.6 s miles. Mother Brook may therefore be considered as having, in addition own drainage area of 1.87 square miles, an area of 66.2 square miles which d to the Charles. Dedham and Boston sheets. *See also* Report of the Massachu State Board of Health upon the sanitary condition of the Neponset Meado the towns of Canton, Sharon, Norwood, Dedham, Milton, and Hyde Park.

Moulton Pond.—Worcester County; town of Rutland; north of Rutland Ce outlet, Mill Brook to Ware River (tributary through Chicopee River to the necticut). Worcester sheet.

Mountain Brook.—Hampden County; town of Brimfield; a stream about 1½ long flowing southward into Mill Brook (tributary through Quinebaug Riv Shetucket and Thames rivers and thus to Long Island Sound). Brookfield s

Mountain Brook.—Franklin County. *See* Mirey Brook.

Mount Ephraim Reservoirs.—Middlesex County; formerly part of the water age system of the metropolitan district of Boston and vicinity; natural o through a small stream to Mystic lakes and thus to Mystic River, which disch into Boston Bay. Boston sheet.

Mud Creek.—Essex County; a tidewater channel west of Plum Island River (rated from the Atlantic Ocean by Plum Island). Newburyport and S sheets.

Muddy Brook.—Hampshire and Hampden counties; towns of Granby and Chic a stretch of the middle course of Stony Brook (Hampshire County). *See* S Brook. Springfield sheet.

Muddy Brook.—Worcester County; rises 1¼ miles west of Hopedale; flows s eastward 4 miles, thence very irregularly eastward into Mill River (tributa Blackstone River and thus through Seekonk and Providence rivers to Narr sett Bay). Blackstone sheet.

Muddy Brook.—Worcester County; a stream originally about 4 miles long, sho the Marlboro and Worcester sheets of United States Geological Survey as near Boylston Center and flowing west and north into Nashua River (tributa Merrimack River); partially flooded out by Wachusett reservoir.

Muddy Brook.—Worcester and Hampshire counties; rises 1 mile west of Ridge flows southwesterly 11 miles into Ware River (tributary through Chicopee to the Connecticut) at the city of Ware; passes through Muddy and several sm ponds. Barre sheet.

Muddy Creek.—Barnstable County; a tidal creek extending from Pleasant southwestward into the town of Chatham. Yarmouth and Chatham sheets.

County; town of Barnstable; three-fourths mile west of
l by a short stream flowing eastward into the stream that
d into Great Bay at the head of Osterville Harbor, Nan-
ble sheet.

Jounty; town of Washington; inlet, the head of Housa-
usatonic River; small. Becket sheet.

ıty; a very small pond in Wenham Swamp just northwest
; miles northeast of Danvers; Lawrence sheet.

County; a small pond one-half mile north of Neponset
f Silver Lake. Abington sheet.

County; town of Kingston; 1½ miles southwest of Monks
.

County; a small pond in the town of Wareham; outlet, a
ı long flowing northward into Red Brook (tributary through
zzards Bay). Plymouth sheet.

ounty; near northwestern boundary of Hyde Park; outlet,
ong flowing southeastward into Stony Brook. Boston sheet.

County; 1½ miles west of Gilbertville; inlet and outlet,
ıry through Ware River to Chicopee River and thus to the
long and one-fourth mile wide. Barre sheet.

: County; 2 miles northeast of the village of Oakham; out-
ong flowing northwestward through several small ponds into
r through Chicopee River to the Connecticut) at the village
ı sheet.

r County; 2 miles east of South Ashburnham; altitude,
:vel; no large inlets; outlet, a stream about a mile long flow-
nto Whitman River (tributary through North Branch of
hua River and thus to the Merrimack). Fitchburg sheet.

ır County; a small pond lying about three-fourths mile west
. Pond and discharging by a stream one-fourth mile long into
River (tributary to Wachusett reservoir). Worcester sheet.

unty; rises east of Turkey Hill and just west of Ipswich, at
ıt above sea level; flows generally northward about 2½ miles
Bull Brook tributary through Rowley River, a tidewater
Island River (separated from the Atlantic Ocean by Plum
ı mile east of Rowley. Salem sheet.

County, town of Pittsfield; one-half mile southeast of the
e; outlet, a stream a mile long, flowing northward into a pond
ch (tributary through west branch of Housatonic River to the
r Barkerville. Pittsfield sheet.

: County; 1½ miles north of Natick; inlet, two small streams
of the pond, one flowing from Pickerel Pond; outlet, a stream
owing south and east through the marsh west of Jennings Pond
Morses Pond to Waban Lake and thus to Charles River).

r County; town of Ashburnham; a small pond about half a
lashua Reservoir; outlet, a stream 2 miles long flowing north-
lers River (tributary to Connecticut River) near North Ash-
Fitchburg sheet.

ROOK.—Bristol County; rises on the east slope of Rattlesnake
f Stoughton, Norfolk County; flows southwestward to Leach
eral southeasterly to Winneconnet Pond; outlet through Mill
River and thus to Narragansett Bay; length, 9 miles. Dedham
ts.

Mulpus Brook.—Worcester and Middlesex counties; rises in Worcester C south of Baberry Hill, at altitude about 610 feet above sea level; flows eastward 19 miles and discharges into Nashua River (tributary to the Merri near Woodside; total fall about 400 feet; marshy through much of its c Groton sheet.

Mumford River.—Worcester County; rises in a pond at West Sutton; flows eastward to Manchaug Pond, thence eastward and southeastward to Bad Luck at East Douglas, northeastward and northward to Whitins Pond, thence eastward to its junction with Blackstone River (tributary to Seekonk Rive thus through Providence River to Narragansett Bay) near Uxbridge; le about 15 miles. Webster and Blackstone sheets.

Munn Brook.—Hampden County; formed in the town of Granville by the un Dickinson and Tillison brooks; Dickinson Brook, the continuation of Brook, rises on the west slope of Bad Luck Mountain and takes a circuitous c passing south, southeast, and northeast to the north base of Sodom Mou where it receives Tillison Brook; from this point Munn Brook flows southeas 1 mile, then northeastward 3½ miles to Westfield, where it enters We Little River (tributary through Westfield River to the Connecticut). Gra sheet.

Musquapog Pond.—Worcester County, east of Rice Hill; outlet, a stream ab miles long flowing southeastward and then northeastward into Quinapoxet (tributary to Wachusett Reservoir), about one-fourth mile below Quina Pond; altitude, about 1,030 feet above sea level; fall of outflowing strea feet. Worcester sheet.

Musquashiat Pond.—Plymouth County; one mile southeast of Scituate drained westward through the tidal marsh by which Bound Brook is disch to Cohasset Harbor; a narrow sand-bar separates this pond from the c Abington street.

Myricks Pond.—Barnstable County; half a mile northeast of village of Bre outlet, a stream flowing southwest and then north into Cape Cod Bay. We sheet.

Mystic lakes.—Middlesex County; a series of three lakes lying between Arli and Winchester; inlet to upper lake, Aberjona River; outlet from lower Mystic River to Boston Bay; combined length of three lakes, 1½ miles; maxi width, one-half mile; formerly part of water supply system of Boston and vic Boston sheet.

Mystic Pond.—Essex County; one-half mile west of Methuen and about 1 northwest of Lawrence; inlet, a stream 1½ miles long and marshy, flowing in the west; outlet, a very small stream flowing northward into Spickett (tributary to the Merrimack); altitude, about 110 feet above sea level; small. Lawrence sheet.

Mystic River.—Middlesex and Essex counties; rises just west of Reading at alt 100 feet above sea level; takes a general southward course for 9 miles to Arli passing through Richardson's and Burbank ponds and Mystic lakes, then southeastward about 7 miles to its junction with Charles River and into B Bay; called on the map Aberjona River between Richardson Pond and M lakes; fall from source to Mystic lakes, 80 feet; principal tributaries, Al Brook and Malden River. Lawrence and Boston sheets.

Nabnasset Pond.—Middlesex County; 1 mile west of West Chelmsford; inlet Flushing Pond; outlet, a stream one-half mile long flowing southeastwa Gilsons Brook (tributary through Stony Brook to the Merrimack); about 1 long. Lowell sheet.

x County; rises in Nagog Pond, 1 mile west of North Acton
:0 feet above sea level; flows southeastward 1 mile into
tary through Fort Pond Brook to Assabet River and thus
r to the Merrimack). Lowell sheet.
: County; about 1 mile south of Nashoba Hill and 1 mile
station; outlet, Nagog Brook (tributary through Fort Pond
er and thus through Concord River to the Merrimack); alti-
ea level; length, 1 mile; maximum width, one-half mile.

ol and Plymouth counties; rises in the town of Freetown;
being known as Fall Brook; flows northward and eastward to
thward through long and Assawompsett ponds to Middleboro
urse is northwesterly to Taunton River (tributary to Narra-
asin includes, in addition to Assawompsett and Long ponds
Pond and a number of smaller ponds in Middleboro. Length
junction with the Taunton to the head of Fall Brook, about
osett and Elders ponds are used by the city of Taunton as a
unicipal supply. Middlesex and New Bedford sheets.
arnstable County; a channel in the marsh southwest of
eet sheet.
icket County; Nantucket Island; one of a series of tidal inlets
f the island. Muskeget sheet.
Dukes County; Martha Vineyard; Gayhead; the southern
ond; separated from the ocean by Stonewall Beach; the pond
n Menamsha Pond and very irregular in outline. Gayhead

dlesex County; rises about one-fourth mile northwest of East
altitude 200 feet above sea level; flows southeastward 4 miles,
il southward course 4½ miles to its junction with Fort Pond
rough Assabet River to Concord River and thus to the Merri-
ibutaries, Nonset and Nagog brooks. Lowell and Framingham

sachusetts and New Hampshire; formed 2 miles north of
nction of the north and south branches (*see* Nashua River,
[Nashua River, South Branch), takes a general northeasterly
on with Merrimack River at Nashua, N. H. For 3 or 4 miles
of the Nashua the fall of the stream is rapid, its bed is rocky,
high; above that point the fall is less for a distance of 8 or 10
nks are still high enough to confine the river except in high
roton to the mouth of the North Branch the stream is very
nd banks are sandy and gravelly, and considerable areas of
ring the streams are at times inundated.
Nashua River has been measured at Clinton by the engineers
n Water and Sewerage Board since July, 1896. Authorities:
Milford, and Manchester sheets. Maps of Metropolitan Water
eological Survey water-supply papers. *See also* pages 283-284

H BRANCH OF.—Formed in the town of Fitchburg by the union
Nookagee rivers. Whitman River, which drains the larger
d the head of the stream and rises on the west slope of Meeting
titude about 1,180 feet above sea level; flows southeastward
en northeastward about 1 mile to the point at which it receives
From this junction the North Branch of Nashua flows north-

eastward 2 miles, then southeastward 14 miles to its junction with South B of Nashua River (tributary to the Merrimack), in Lancaster. Principal trib of Whitman River above Fitchburg, the stream that collects the wate Meeting House, Wachusett, and Grass ponds. Fitchburg, Groton, and Mar sheets.

Nashua River, South Branch.—Outlet of Wachusett reservoir at Clinton; origi formed by junction of Quinapoxet and Stillwater Rivers at Oakdale, Wor County; from Clinton takes a general northeasterly course for 2 miles to its tion with the North Branch of Nashua River at Lancaster. The tributaries the reservoir drain the eastern and southern slopes of Wachusett Mour drainage area above Clinton, 118.9 square miles. Worcester and Marlboro s

Nasketucket River.—Bristol County; a stream about 3 miles long, flowing s eastward into Little Bay at the head of Nasketucket Bay, a branch of Buz Bay; tidal below Nasketucket. New Bedford sheet.

Natty Pond.—Worcester County; northern part of the town of Hubbardston; Natty Pond Brook to Canesto Brook (tributary through Burnshirt River to River and thus through Chicopee River to the Connecticut); one-half mile one-fourth mile wide. Barre sheet.

Natty Pond Brook.—Worcester County; rises in the northern part of the to Hubbardston; flows southeastward 3½ miles passing through Natty Pond, southwestward 1½ miles into Canesto Brook (tributary through Burnshirt to Ware River and thus through Chicopee River to the Connecticut). sheet.

Naukeag ponds, upper and lower.—Worcester County; town of Ashburnham upper pond is about a mile long and nearly half a mile wide, and discharges stream 1 mile long flowing northwestward into Lower Naukeag Pond, the of which is a stream flowing north of west into Millers River (tributary to necticut River). The fall between the upper and lower ponds is about 70 Between the lower pond and the river the fall is about 15 feet. Fitchburg

Neal Pond.—Essex County; a very small pond 1½ miles west of Merrimac; alti about 80 feet above sea level; outlet, a stream flowing southeastward 4 mile Merrimack River, 2 miles east of Haverhill. Haverhill sheet.

Nelson Island Creek.—Essex County; a tidewater channel west of Plum I River (separated from the Atlantic Ocean by Plum Island). Salem sheet.

Neponset Reservoir.—Norfolk County; town of Foxborough; outlet, Nep River to Dorchester Bay; altitude, about 280 feet. Franklin and Dedham s

Neponset River.—Norfolk and Suffolk counties; rises in Neponset Reservoir town of Foxborough; flows in a general northeasterly course and discharge Dorchester Bay; length, about 18 miles; total fall, about 280 feet, of whic feet occurs in the 10 miles below the reservoir and above the Great Mea principal tributaries, Canton River or East Branch and Mother Brook, flows from Charles River through East Dedham and Hyde Park and join main river about 1½ miles below the Great Meadows; drainage area above M Brook, 96.28 square miles. As Mother Brook is legally entitled to one-thi the flow of Charles River, which at the point where the brook begins drai area of 198.6 square miles, it may be considered as having an additional dra area of 66.2 square miles, or 68.07 square miles, including area tributary dir to Mother Brook; the drainage area of the Neponset at its mouth including third of the drainage area of Charles River above Mother Brook is 180.34 s miles. Franklin, Dedham, and Boston sheets. *See also* Report of the M chusetts State Board of Health upon the sanitary condition of the Nep Meadows in the towns of Canton, Sharon, Norwood, Dedham, Milton, and Park, 1897.

Neponset River, East Branch. *See* Canton River.

cester County; town of Dana; an expansion of the Middle
ift River (tributary through Ware River to Chicopee River
iecticut), extending northward from North Dana nearly 2
sheet.

R.—Bristol County; a pond near the head of Acushnet River
he city of New Bedford for municipal supply); principal
ushnet River; outlet, Acushnet River to New Bedford Har-
d New Bedford sheets.

arnstable County; town of Dennis; a marshy channel extend-
Dennis into the marsh northeast of Yarmouth Port, where it
Garden Creek. Yarmouth sheet.

stable County; a small pond 2¼ miles north of the village of
t sheet.

lesex County; just west of North Chelmsford; connected by a
on Stony Brook (tributary to the Merrimack) at West Chelms-
mile long. Lowell sheet.

ester County; on Quinsigamond River (tributary through
Seekonk River and thus through Providence River to Narra-
vest of Harlow Hill. Marlboro sheet.

County; rises in a swamp about a mile northwest of Danvers
above sea level; flows northwestward 3 miles into Ipswich
ughout part of its course. Salem sheet.

ipshire County; town of Wilbraham; southwest of North Wil-
e North Branch or head of Mill River (tributary to the Con-
sheet.

ester County; one mile southwest of the village of Mendon;
rook to West River (tributary to Blackstone River and thus
nd Providence rivers to Narragansett Bay). Blackstone sheet.

ester County; 3 miles southeast of Oxford; outlet through
Lake Chaubunagungamaug (outlet Millbrook to French River
Quinebaug River to Shetucket River, Thames River, and
d); very small. Webster sheet.

Plymouth County; on the southern edge of Great Cedar Swamp;
the swamp passing through Nunkets Pond; outlet northward to
utary through Matfield River to Taunton River and thus to
). Taunton sheet.

Hillsboro County, N. H., Middlesex County, Mass.; rises in
the town of Brookline, N. H.; flows southeastward 7 miles, then
le into Nashua River (tributary to the Merrimack). The prin-
ing into Potanota Pond is Mitchell Brook; altitude of Potanota
feet above sea level; fall of Nissitisset River between the
River, about 100 feet; principal tributaries of Nissitisset River
, Wold, Gulf, Sacker, and Mine brooks. Milford and Groton

ex County; rises on the east slope of Pond Hill at altitude 100
vel; flows generally southward through a small pond into Merri-
-half mile east of Merrimacport; fall, about 80 feet. Newbury-

Nantucket County; Nantucket Island; south shore; separated
y a narrow beach. Nantucket sheet.

-Plymouth County; town of Pembroke; one-fourth mile north of
nto which it discharges by a southward-flowing stream. Abington

Nod Brook.—Middlesex County; a stream about 1 mile long flowing westward
Nashua River (tributary to the Merrimack) near Paper Mill village in the to
Groton. Groton sheet.

Nonacoicus Brook.—Middlesex County; rises in a marsh north of Rocky Hill,
2 miles southwestward through Long Pond to Sandy Pond, thence in general
ward into Nashua River (tributary to the Merrimack); passes through Plow
Pond south of Ayer; principal tributary, Bowers Brook, which flows into he
the pond just south of Ayer. Groton sheet.

Nonset Brook.—Middlesex County; rises one-half mile south of Westford bet
Blakes Hill and Burns Hill at altitude 300 feet above sea level; takes a ge
southward course for 2½ miles to its junction with Nashoba Brook (tribu
through Fort Pond Brook to Assabet River and thus through Concord Riv
the Merrimack) about one-half mile east of Nashoba Hill. Lowell and Fran
ham sheets.

None Such Pond.—Middlesex County; about 3 miles northeast of Natick; inl
small stream rising near Weston and flowing south and southwest; outlet, a st
2 miles long flowing southward into Morses Pond (tributary through Waban
to Charles River). Framingham sheet.

Nookagee River.—Worcester County; rises on the south slope of Little Wa
Mountain in a small pond at altitude 1,130 feet above sea level; takes a ge
southeasterly course to West Fitchburg, where it joins Whitman River to
North Branch of Nashua River (tributary through Nashua River to the M
mack); length, about 9 miles; passes through several small lakes. Called Ph
Brook between Ashburnham and a small lake a mile northwest of Black
village. Fitchburg sheet.

Northam Creek.—Berkshire County; rises on Bald Mountain in the town of Cl
burg; flows southward 2 miles into Hoosic River (tributary to the Hudson) 2
west of North Adams. Greylock sheet.

North Branch of Nashua River. *See* Nashua River, North Branch of.

North Brook.—Hampshire County; town of Westhampton; head of North Br
of Manhan River (tributary through Manhan River to the Connecticut).
terfield sheet.

North Brook.—Worcester County; rises about 1 mile southeast of Clinton, at alti
380 feet above sea level; flows generally southward 2 miles, northeastward 1
southeastward 3½ miles, and again northeastward about one-half mile into As
River (tributary through Concord River to the Merrimack). One-half mile
its source it passes through Clamshell Pond, and near South Berlin through a
about one-fourth mile long. Marlboro sheet.

North Meadow Pond.—Hampden County; north of North Blandford; on Pe
Brook (tributary to Springfield reservoir on Westfield Little River, p. 424); s
on the map as 1 mile long and one-fourth mile wide, but has been drained.
ville sheet.

North Pond.—Berkshire County; town of Florida; outlet, a stream three-fo
mile long flowing northeastward into Tower Brook (tributary to Cold Rive
thus through Deerfield River to the Connecticut). Greylock sheet.

North Pond.—Franklin County; town of Orange; southwest of Walnut Hill; na
outlet, Middle Branch of Swift River, the head of Swift River (tributary thr
Ware River to Chicopee River and thus to the Connecticut); one-half mile
and one-half mile wide. Diverted to Millers River basin for water supp
Orange. Warwick sheet.

North Pond.—Middlesex and Worcester counties; inlet and outlet, Mill R
which flows through it to Blackstone River (tributary to Seekonk River and
through Providence River to Narragansett Bay); more than 2 miles long;
one-fourth wide. Blackstone sheet.

County; Tuckernuck Island; northwest shore; tidal.

County; north of the city of Worcester; outlet, a stream
lowing eastward into Mill Brook (tributary through Black-
: River and thus through Providence River to Narragansett
lle; nearly a mile long and one-half mile wide. Worcester

ICH.—Franklin County. *See* North River.
unty; formed at Peabody by the junction of Goldthwait
ows generally eastward 2 miles through Peabody and Salem,
n of Beverly Harbor. Salem sheet.
ı County; rises about 1 mile north of North Abington;
miles, then in general northeastward 12 miles, then south-
s to Massachusetts Bay; called French Stream at its head
'er through the greater part of its middle course; principal
er River, Indian Head Brook, Herring Brook, and First,
rring brooks. The basin contains many marshy tracts and a
ɔington and Duxbury sheets.
ANCH.—Franklin County; rises in the town of Whittington,
, flows southward 3 miles, then southeastward 9 miles to its
'anch (tributary through North River to the Deerfield and
ıt) near Lyonsville in the town of Coleraine. Wilmington,
ld sheets.
n County, Vt., Franklin County, Mass.; formed near Lyons-
ɔlrain by the union of its east and west branches. East
the larger area and is therefore considered the continuation
:ises 1½ miles south of East Wilmington, Vt., and takes a
course to a point near Colrain, Mass., where it turns
outh, to receive the West Branch; below this junction North
ıd southwestward to the point at which it enters Deerfield
he Connecticut) 1½ miles north of Shelburne Falls; length
ch, about 20 miles. Wilmington, Hawley, and Greenfield

ristol County; town of Norton; inlet, Rumford River; out-
to Threemile River (tributary through Taunton River to
pond about 2 miles long and nearly a mile wide. Taunton

shire County; town of Huntington; outlet, Pond Brook to
ıtary to the Connecticut); one-half mile wide; nearly three-
hesterfield sheet.
re County; rises on Mount Greylock; flows north of east
Notch to North Adams, where it enters Hoosic River (tribu-
Greylock sheet.
ne between Plymouth and Bristol counties; in the Great
;, a stream one-half mile long, flowing southeastward through
ɔenicket Pond, which discharges northward to Town River
Iatfield River to Taunton River and thus to Narragansett
ɪt.
lesex County; 1½ miles south of Billerica, at altitude 200 feet
ɪt, two very small streams, unnamed on the map; outlet, a
long flowing into Concord River (tributary to the Merrimack);
; maximum width, one-fourth mile. Lowell sheet.

Oak Hill Pond.—Worcester County; a small pond lying one-half mile southe Spectacle Pond in the town of Lancaster; discharges by a stream one-fourt long into the brook by which Spectacle Pond is connected with North Bra Nashua River (tributary through Nashua River to the Merrimack). Groton

Oldham Pond.—Plymouth County; town of Pembroke; length, about 1 mile; one-half mile. Abington sheet.

Old Harbor Creek.—Barnstable Creek; town of Sandwich; a tidal channel marsh east of Sandwich; connects with Mill Creek. Barnstable sheet.

Old Swamp River.—Norfolk County; rises in the town of Rockland; flows north 4 miles into Whitman Pond (outlet, Weymouth Back River). Ab sheet.

Onota Brook.—Berkshire County; the outlet of Lake Onota in Pittsfield; tri through the west branch of Housatonic River to Housatonic River; 1½ mile Pittsfield sheet.

Onota Lake.—Berkshire County; town of Pittsfield; principal inlets, Danie Lulu brooks; outlet, Onota Brook to West Branch of Housatonic River (tri to the Housatonic). The main lake is more than a mile long and about o mile wide at its widest part. Pittsfield sheet.

Orcutt Brook.—Franklin County; rises just north of the New Hampshire- chusetts boundary line, in the southeastern part of the town of Winc N. H.; flows southeastward 4 miles, then west of south 6 miles to its junctio Millers River (tributary to the Connecticut) at West Orange. Called Brook above the pond east of Hockanum Hill. Warwick sheet.

Osgood Brook.—Franklin County; rises in a pond about 3 miles southeast of Falls; flows northwestward 2 miles into Millers River (tributary to the Con cut) 1½ miles east of Millers Falls. Warwick sheet.

Osgood Brook. Franklin County; town of Wendell; rises one-half mile north village of Wendell; flows northward 1½ miles, then northeastward 2 mile Millers River (tributary to the Connecticut) near Wendell depot. Warwick

Otis Reservoir.—Berkshire and Hampden counties; towns of Otis and To principal inlet, stream from Benton Lake; outlet, a stream a mile long f westward into the Farmington River (tributary to the Connecticut); a large voir occupying a natural site; altitude, 1,422 feet. The reservoir is very i lar in shape, is about 3 miles in maximum length and nearly one-half m average width. Its operation greatly affects the low-water flow of Farmi River. Sandisfield sheet.

Otter Brook.—Franklin County; town of Gill; rises on the north slope of B Hill; flows southeastward 1 mile, then southward 1 mile into Connecticut Warwick sheet.

Otter Pond Brook.—Franklin County; town of Gill; rises 2 miles north of Hill; takes a circuitous but in general easterly course to its junction wit Brook (tributary to Connecticut River); length, 2½ miles. Greenfield shee

Otter River.—Worcester County; rises in the town of Hubbardston; flows eastward about 3 miles, then very irregularly northwestward to its junctio Millers River (tributary to the Connecticut); length, about 14 miles; pri tributaries, Foster, Pond, Kneeland, Bailey, and Trout brooks. The contains many ponds, the largest being Crystal Lake, in Gardner. Fitchbu Winchendon sheets.

Overlook Reservoir.—Worcester County; about 1 mile northwest of the Fitchburg.

Oyster Creek.—Barnstable County; a tidal channel connecting Oyster Pon Stage Harbor and Nantucket Sound in the town of Chatham. Chatham sh

Oyster Pond.—Barnstable County; 1½ miles southwest of the city of Fal Falmouth sheet.

le County; town of Chatham; outlet, Oyster Creek to Stage
t Sound; tidal. Chatham sheet.
ounty; Marthas Vineyard; one of a series of ponds on the
ıd, separated from the ocean by a continuous barrier beach;
n Tisbury Great Pond and Edgartown Great Pond. Marthas

in County; town of Orange; northwest of Fryville; outlet,
ile long flowing southwestward into West Branch of Tully
ugh Tully River to Millers River and thus to the Connecti-
uble, the parts being connected by a short eastward flowing
erted from the East Branch of Tully River into the eastern
by a canal about one-fourth mile long. Winchendon sheet.
ex County; rises in Tophet Swamp, one-half mile north of
180 feet above sea level; flows southeastward 1½ miles, then
les into Concord River (tributary to the Merrimack) 1 mile
ca; marshy. Lowell sheet.
County; a tidewater channel into Greenes Creek (tributary
er and thus to the Atlantic Ocean). Salem sheet.
arren River.
stol County; rises in Sassaquin Pond; flows southwesterly
dar Swamp and along the west border of Great Cedar Swamp,
edford, thence in general west of south to Slocums River,
ses into Buzzards Bay; length, about 15 miles. New Bedford
ts.
able County; town of Truro; a channel in the marsh extending
int near the Pamet River life-saving station on the ocean to
st cutting off the north end of Cape Cod Peninsula. Wellfleet

dlesex County; rises about 2 miles south of Maynard, at altitude
sea level; takes a very irregular course eastward to its junction
r (tributary through Concord River to the Merrimack); length,
throughout much of its course. Framingham sheet.
County; Marthas Vineyard; one of a series of ponds on the
island, separated from the ocean by a continuous barrier
mile east of Oyster Pond and a mile west of Edgartown Great
ineyard sheet.
hire County; town of Otis; 1 mile northwest of East Otis;
2 miles long flowing southwestward into Farmington River
Connecticut). Sandisfield sheet.
ex County; rises 1 mile northwest of West Boxford and 2½
ı Andover, at altitude 160 feet above sea level; flows southeast-
gh several small ponds, northeastward 7 miles, and then takes
ourse eastward for 10 miles to Plum Island River, a tidewater
s to the Atlantic Ocean; passes through Rock and Pentucket
etown and through several small ponds unnamed on the map;
ut its course. On the Salem sheet the stretch of Parker River
rgetown northward through the swamp is called Penn Brook;
ries, Beaver Brook, Mill River (or Creek), and Little River.
hill, Newburyport, and Salem sheets.
arnstable County; town of Yarmouth; rises in Plashes Pond;
2½ miles into Nantucket Sound; tidal in its lower course. Yar-

Park Pond.—Middlesex County; 3 miles northwest of Lowell, one-fourth mile of Tyngs Pond; surrounded by a marsh which is drained southward thi Scarlet Brook to the Merrimack. Lowell sheet.

Pasture Brook.—Essex County; rises on the east slope of Huy Slow Hill, just of Rowley, at altitude 60 feet above sea level; flows eastward 1 mile, then n westward 2 miles into Mill Creek (tributary through Parker River to Plum I River and thus to the Atlantic Ocean) near Glen Mills. Salem sheet.

Pasture Pond.—Barnstable County; one of a group of ponds northwest of Prov town. Provincetown sheet.

Patch Meadow Brook.—Middlesex County; rises about 2½ miles west of Bille and 1 mile east of Tophet Swamp, at altitude 180 feet above sea level; southwestward 1¼ miles into River Meadow Brook (tributary through Co River to the Merrimack). Lowell sheet.

Pattaquattic Pond.—Hampden County; town of Palmer; a small pond one-e mile east of Ware River (tributary through Chicopee River to the Connecti connected with Forest Pond. Palmer sheet.

Pea Brook.—Franklin County; town of Conway; rises a mile southeast of Pine flows northwestward 1½ miles, then northeastward one-half mile into Bear (tributary through Deerfield River to the Connecticut). Greenfield sheet.

Pearl Hill Brook (north).—Worcester and Middlesex counties; rises on the n east slope of Pearl Hill in Worcester County, at altitude 610 feet above sea flows northeastward into Middlesex County and discharges into Squanna River (tributary through Nashua River to the Merrimack) just below A Swamp; length, about 5 miles; fall, 270 feet. Fitchburg sheet.

Pearl Hill Brook (south).—Worcester County; rises about 1 mile east of Hill, about 480 feet above sea level; flows southward 2½ miles, then south ward one-half mile into Baker Brook (tributary through North Branch of N River to Nashua River and thus to the Merrimack). Fitchburg sheet.

Pebble Brook.—Head of Westfield Little River (tributary through Westfield to the Connecticut). Granville sheet.

Pecks Brook.—Berkshire County; rises on the south slope of Mount Greylock; southeasterly to Adams, where it enters Hoosic River (tributary to the Hud 3½ miles long. Greylock sheet.

Pecowsic Brook.—Hampden County; rises on the north slope of McCarthy H the town of Long Meadow; flows westerly in a very circuitous course into necticut River a mile south of the mouth of Mill River in Springfield; le 6 miles. Springfield sheet.

Pecuanticiot River. *See* Mill River, Bristol County.

Pelham Brook.—Franklin County; rises just south of the Massachusetts-Ver boundary, in the town of Rowe; flows southward 2½ miles, then southwest 4½ miles into Deerfield River (tributary to the Connecticut) at Zoar. Ha sheet.

Penn Brook. *See* Parker River.

Penny Brook.—Essex County; rises in Tomlin Swamp; flows northwestward half mile into Walden Pond, then westward one-half mile into Hawkes (tributary to Saugus River, which discharges into Boston Bay) at North Sa Boston Bay sheet. Map in report of Massachusetts State Board of Health, pa

Penny Brook.—Hampshire County; town of Ware; a stream less than a mile flowing southwestward into Beaver Brook (tributary through Ware Riv Chicopee River and thus to the Connecticut). Palmer sheet.

Pentucket Pond.—Essex County; just north of Georgetown; inlet, Parker from Rock Pond; outlet, Penn Brook and Parker River (tributary through Island River to the Atlantic Ocean); altitude, 80 feet above sea level. S sheet.

ire County, N. H., Franklin County, Mass.; rises in the N. H.; flows southwestward into Connecticut River near s.; length, 5 miles, of which only 1 mile is in Massachu-t.

r County; 1 mile northwest of East Brookfield and one-urnace Pond; two inflowing streams, one from a small pond nd the other, Dunn Brook, which flows through it and is ; River (tributary through Chicopee River to Connecticut).

r County; town of Dudley; outlet, a stream less than a mile stward into Merino Pond (outlet to French River and thus , Shetucket, and Thames rivers to Long Island Sound).

ble County; 1 mile northwest of the village of Wakeby and of Wakeby Pond; natural outlet through Wakeby Pond, and antucket Sound. Barnstable sheet.

ounty; in the town of Methuen, 4 miles west of Lawrence; eet above sea level; outlet, a small stream about a mile long ard into Bartletts Brook (tributary to Merrimack River); -fourths mile; maximum width, about one-fourth mile.

er County; town of Gardner; rises on the east slope of Ray stward 2 miles, then northwestward 1 mile into Foster Brook River and thus through Millers River to the Connecticut); w from South Gardner Reservoir. Fitchburg sheet.

shire County; rises in the southeastern part of the town of utheastward into a pond on Housatonic Branch (tributary ch of Housatonic River to the Housatonic) at Lower Barker-les. Pittsfield sheet.

mouth County; rises near West Duxbury; flows southeastward eastward 2 miles to its junction with South River (tributary Bay); passes through two ponds. Abington and Duxbury

rcester County; a brook about a mile long connecting two of l lakes on Nookagee River between Ashburnham and Black-shy. Fitchburg sheet.

rkshire County; town of North Adams; a stream 2 miles long vest into Hoosic River (tributary to the Hudson) a mile south Greylock sheet.

Worcester County; 1 mile southeast of the village of Phillip-am flowing eastward into the swamp on Burnshirt River (tribu-e River to Chicopee River and thus to the Connecticut) east of Winchendon sheet.

pden County; town of Agawam; rises in the western part of the outheastward 2½ miles, then passes into Connecticut and takes a to its junction with Muddy Brook, through which it is tributary nd thus to Connecticut River. Springfield and Hartford sheets.

ampden County; a small pond north of Ludlow and about 1 mile e River (tributary to the Connecticut). Palmer sheet.

iddlesex County; in the marsh 2 miles north of Natick; drains nd to Jennings and Morses Ponds and thus through Waban Lake . Framingham sheet.

lymouth County; town of Wareham; 2 miles north of Onset.

Pierce Brook.—Worcester County; town of West Brookfield; a stream about a long flowing southeastward into Ellis River (tributary through Quaboag Ri Chicopee River and thus to the Connecticut). Barre sheet.

Pierpoint Meadow Pond.—Worcester County; one mile southeast of South Char outlet, a stream one-eighth mile long flowing northward into the stream con ing Charlton Reservoir with Little River (tributary through French Riv Quinebaug River and thus through Shetucket and Thames rivers to Long I Sound). Webster sheet.

Pilgrim Lake.—Barnstable County; 2 miles east of Provincetown; north of Pi Beach; 1½ miles long. Provincetown sheet.

Pine Brook.—Plymouth County; town of Kingston; rises one-half mile south of Duxbury; flows southward into Jones River (tributary to Kingston Bay); p through several ponds; length, 4 miles. Abington sheet.

Pine Creek.—Essex County; a tidewater channel on Plum Island, about 1½ long and flowing southward into Plum Island River opposite Great Neck. S sheet.

Pine Hill Brook.—Worcester County; town of Barre; rises on the south slope o row Hill; flows southward 3 miles into Ware River (tributary through Chi River to the Connecticut). Barre sheet.

Pine Point River.—Plymouth County; a tidal channel in Duxbury Marsh. Dux sheet.

Pines River.—Essex and Middlesex counties; rises above Swamp Pond, just of Malden, at altitude 100 feet above sea level; takes a very irregular course ward for about 6 miles, through Malden, and joins Saugus River at its entran Boston Bay. Boston and Boston Bay sheets.

Pine Swamp Brook.—Bristol County; town of Taunton; rises in Prospect Hill north of Taunton; flows eastward about 3 miles to Kings Pond, then west of 3 miles into Taunton River (tributary to Narragansett Bay) about a mile e the city of Taunton, principal tributary, stream from Gushee Pond. Ta sheet.

Plainfield Pond.—Franklin County; north of West Mountain; outlet, King Br Chickley River (tributary through Deerfield River to the Connecticut). H sheet.

Plantain Pond.—Berkshire County; southeastern part of the town of Mount ington; between Mount Plantain and Race Mountain; outlet, a stream 1½ long flowing southeasterly into Schenob Brook (tributary to the Housat Sheffield sheet.

Plashes Pond.—Barnstable County; town of Yarmouth; two small ponds conn by a short stream; outlet, Parkers River to Nantucket Sound. Yarmouth

Pleasant Brook.—Worcester County; town of Barre; rises 2 miles northeast of th lage of Barre; flows southward 1½ miles, then southwestward 1½ miles to P River (tributary through Ware River to Chicopee River and thus to the necticut). Barre sheet.

Pleasantdale Pond.—Worcester County; town of Sutton; an expansion of Spring Brook (tributary to Blackstone River and thus through Seekon Providence rivers to Narragansett Bay). Blackstone sheet.

Pleasant Pond.—Essex County; in Wenham Swamp, 3½ miles northeast of Dar inlet, a very small stream coming in from the south; outlet, a stream 1 mile flowing somewhat northwestward into Ipswich River; length, about on mile; maximum width, less than one-fourth mile. Salem sheet.

Plowshop Pond.—Middlesex County; in the southern part of Ayer; inlets, B Brook and stream from Sandy Pond. Groton sheet.

nty; a small pond just east of Haverhill; outlet, a small
lf mile long flowing southward into Merrimack River at
ıbout 140 feet above sea level. Haverhill sheet.

ssex County; a tidal channel separated from the ocean by
eiving the drainage from the area between the mouth of the
mouth of the Ipswich. The principal stream in this area
e limits of the swamp is Parker River. The other streams in
ıum Island River are creeks and rivers in name only, as most
idewater channels. Newburyport and Salem sheets.

-Berkshire County; town of Hinsdale; two inflowing streams;
ee-fourths mile long flowing northeastward into Housatonic
t.

)uth County; town of Lakeville; the eastern arm of Assa-
e Assawompsett Pond. Middleboro sheet.

unty; a very small pond about a mile south of Andover; out-
lowing into Shawsheen River (tributary to the Merrimack);
et above sea level. Lawrence sheet.

n County; town of Leverett; rises 1 mile south of North
hward to East Leverett, where it units with Roaring Brook
(tributary to the Connecticut); 3½ miles long. Belchertown

ın County; town of Montague; rises on the west slope of Dry
west 1½ miles to Great Pond, thence southwestward 1½ miles
r (tributary to the Connecticut). Greenfield sheet.

en County; rises in a pond 2 miles north of West Granville;
ailes and unites with Hubbard Brook to form the East Branch
er (tributary through Farmington River to the Connecticut).

len County; rises in Hampton Pond; flows southward 2 miles,
rse Pond, then southwesterly 3 miles into Powder Mill Brook
Westfield River to the Connecticut). Springfield sheet.

len County; rises on the north slope of Barnes Mountain, in
ıd; flows northeasterly 3½ miles, southeastward 1 mile, then
rd one-half mile to its junction with Pebble Brook and thus
ervoir on Westfield Little River. *See* Westfield Little River.
, stream from Blair Pond. Granville sheet.

shire County; rises in Norwich Pond in the town of Hunting-
stward 3 miles into Westfield River (tributary to the Connec-
ld sheet.

ester County; city of Gardner; a stream about 2 miles long
of small ponds south of Crystal Lake and flowing southwest-
River (tributary through Millers River to the Connecticut).
'inchendon sheets.

-Norfolk County; rises in Ponkapoag Pond in the eastern part
ıton; flows westward one-half mile, then northwestward 2 miles
ver in the Great Meadows. Dedham sheet.

Norfolk County; Canton and Randolph townships; outlet, Ponka-
ponset River. Dedham sheet.

Berkshire County; towns of Lanesboro and Pittsfield; principal
h of Housatonic River, which flows through it to its junction
River. The lake is 1½ miles long, about 1 mile wide, and con-
ll islands. Berlin, Greylock, Pittsfield, and Becket sheets.

ΟK. *See* Satucket River.

Popple Hill Brook.—Franklin County; rises on the east slope of Popple Hill; fl northward 1½ miles into Roaring Brook (tributary through Mill River to Connecticut). Northampton sheet.

Populatic Pond.—Norfolk County; 1 mile southeast of Medway; drained by Cha River, which flows across its northern end. Franklin sheet.

Poquoy Trout Brook.—Plymouth County, town of Middleboro; rises about 1 r southwest of the city of Middleboro; flows northwestward 4 miles into Taun River (tributary to Narragansett Bay). Middleboro sheet.

Porter River.—Essex County; a tidewater channel just east of Danvers; len southeastward about 1 mile to Danvers River and thus to the Atlantic. The h of Porter River is called Frost Fish Brook. Salem sheet. *See* Frost Fish Bro

Potash Brook.—Hampden County; rises near Blandford; flows south of east miles to Salmon Falls, where it enters Westfield River (tributary to the C necticut); principal tributary, stream from Hazzard Pond. Granville shee

Potash Brook.—Hampshire County; town of Williamsburg; head of Wright Ri (tributary through Mill River to the Connecticut). Northampton sheet.

Potash Brook.—Middlesex County; rises southeast of Marsh Hill, 1½ miles nort Centralville, at altitude 160 feet above sea level; flows southeastward about o half mile into Richardson Brook (tributary through Trout Brook to the Me mack). Lowell sheet.

Potash Brook.—Worcester County; rises 1½ miles southwest of Barre Falls; f southwestward into Ware River (tributary through Chicopee River to the C necticut); 1 mile long. Barre sheet.

Pottapaug Pond.—Worcester County; east of Pottapaug Hill; a large pond on East Branch of Swift River (tributary through Swift River to Ware River a thus through Chicopee River to the Connecticut) in the town of Dana. Ba sheet.

Poucha Pond.—Dukes County; Chappaquiddick Island; east of Marthas Viney separated from Nantucket Sound on the east by a narrow barrier beach; c nected by a channel extending from its northeastern end to Cape Poge B east of Edgartown Harbor. Marthas Vineyard sheet.

Powder Mill Brook.—Hampden County; rises 1 mile southeast of the villag Montgomery; flows southeastward 7½ miles to its junction with Westfield R (tributary to the Connecticut), 1 mile below the mouth of Little River. Gr ville and Springfield sheets.

Powow River.—Rockingham County, N. H., and Essex County, Mass.; rises in town of Sandown in Rockingham County, N. H., at altitude 240 feet above level; flows generally south of east 7 miles through Angle and Country po then northward 1 mile into a swamp through which its passes in a general e ward direction, and takes a very irregular course southeastward 4½ miles, cros into Essex County, Mass., and around the south slope of Ring Hill. Just of Ring Hill it again flows northward into New Hampshire, where it make abrupt turn and takes a southeastward course for 3½ miles into Massachus passing through Lake Garner and discharging into the Merrimack at Salisb Point; total length, about 22 miles. Haverhill and Newburyport sheets.

Prankers Pond.—Essex County; about 2 miles northeast of Melrose; inlet, Sau River; outlet, Saugus River to Boston Bay; length, about three-fourths m maximum width, about one-fourth mile. Boston sheet.

Pratt Brook.—Worcester County; town of Barre; formed near Barre Plains by junction of Burrow and Bell brooks. Burrow Brook, considered the contin tion of Pratt Brook, rises in the town of Oakham and flows northwesterly to junction, below which Pratt Brook flows westward into Ware River (tribut through Chicopee River to the Connecticut); length to head of Burrow Bro 4½ miles; below mouth of Bell Brook, 1 mile. Barre sheet.

County; town of Upton; near head of Center Brook, which
Vest River (tributary to Blackstone River and thus through
ence rivers to Narragansett Bay). Blackstone sheet.

e County, N. H., and Worcester County, Mass.; rises south
ntain; flows southerly to its junction with Millers River 4
Vinchendon, Mass.; called Scott Brook above a small pond
ws below Fitzwilliam, N. H.; length to head of Scott Brook,
ck and Winchendon sheets.

ster County; town of Barre; rises 2 miles north of west from
amsville; flows southward into Ware River (tributary through
the Connecticut) at Barre Plains; length, 8 miles; principal
at, Galloway, and Smith brooks; passes through many small
t.

ex County; rises 3 miles southwest of Danvers, at altitude
level; flows generally southeastward 4 miles to its junction
Brook to form North River (which joins the Atlantic Ocean
); marshy throughout much of its course. Salem sheet.

—Bristol County; town of Taunton; north of the city of Taun-
Swamp Brook to Taunton River (tributary to Narragansett
heet.

rkshire County; northwestern part of the town of Egremont;
eams; outlet, a stream a mile long flowing north and east into
utary to the Housatonic). Sheffield sheet.

lymouth County; formed by two branches that unite near East
onger branch rises in the town of Marshfield at an altitude of
ove sea level and flows in general southwestward about 3 miles;
ion the brook flows northwestward and westward 2½ miles into
tributary to North River). Duxbury and Abington sheets.

ddlesex County; 1½ miles south of Maynard; altitude, 200 feet
; outlet, a stream flowing northwestward 1½ miles into Assabet
through Concord River to the Merrimack). Framingham sheet.

Middlesex County; a stream about 2 miles long rising 2 miles
end Harbor and flowing eastward into Squannacook River (tribu-
ashua River to the Merrimack). Groton sheet.

anklin County; town of Greenfield; a stream 2 miles long flowing
into Green River (tributary through Deerfield River to the Con-
le south of the mouth of Glen Brook. Greenfield sheet.

Vorcester County; a stream about 1½ miles long, rising in the hills
itchburg and flowing southeastward into North Branch of Nashua
ry through Nashua River to the Merrimack). Fitchburg sheet.

K.—Norfolk County; rises in the marsh east of West Dedham;
tward into Neponset River in the Great Meadows; length, 4 miles.
t.

K.—Worcester County; town of Sutton; rises a mile west of Pur-
; flows southeastward and eastward to Burts Pond; thence south-
tins Pond on Mumford River (tributary to Blackstone River and
Seekonk and Providence rivers to Narragansett Bay); length, 3
kstone sheet.

—Hampshire County; town of Pelham; rises a mile north of the vil-
m; flows southeastward 3 miles into the West Branch of Swift River
rough Swift River to Ware River and thus through Chicopee River
cticut). Belchertown sheet.

Putnam Brook.—Middlesex County; rises in a swamp on the south slope o
bins Hill, 1 mile northeast of South Chelmsford at altitude 180 feet abo
level; flows northeastward 1½ miles into River Meadow Brook (tributary t
Concord River to the Merrimack) near Chelmsford Center. Lowell sheet.

Pye Brook.—Essex County; rises in Spoffords Pond, 2 miles southeast of
Boxford, at altitude 120 feet above sea level; flows generally southeastw
miles to its junction with Howlett Brook to form Miles Brook (tributary to I
River); passes through Four Mile Pond; marshy. Lawrence and Salem s

Quaboag Pond.—Worcester County; town of Brookfield; several inflowing st
the most important being East Brookfield River, considered the contin
of Quaboag River; outlet, Quaboag River to Chicopee River and thus
Connecticut; the pond is triangular in shape and measures about a mile
each side. Brookfield sheet.

Quaboag River.—Worcester and Hampden counties; the most southerly
three principal tributaries of the Chicopee; flows from Quaboag Pond i
town of Brookfield; the pond receives as its principal feeder East Broo
River, whose principal tributary, Sevenmile River, may be considered th
of the Quaboag. Sevenmile River rises in the town of Rutland a mile sou
of the southern end of Long Pond and flows southwesterly to Spencer, w
enters the pond from which East Brookfield River flows southwesterl
Quaboag Pond; from Quaboag Pond, Quaboag River flows northwestw
West Brookfield, where it receives the outlet of Wickaboag Pond, southwe
to Warren, westward to a point a mile west of West Warren, then southw
the western base of Fenton Mountain, from which point its general co
northwestward to Three Rivers where it joins Ware River to form Chicopee
(tributary to the Connecticut); length of the Quaboag below Quaboag Po
miles; total drainage area above Three Rivers, 210 square miles; principal tri
of East Brookfield River below Sevenmile River is Fivemile River, which
through Brooks and Furnace ponds and drains parts of Oakham, New Bra
Spencer and North Brookfield; the most important tributary of Seve
River is Turkey Brook; below Quaboag Pond, Quaboag River receives Coy
the outlet of Wickaboag Pond, Ellis River, and Kings Brook from the
Blodgett Mill, Chicopee, and Twelvemile brooks from the south. The ar
and north of Brookfield contains many ponds. Gaging stations at West W
1904–1907, and at West Brimfield, 1909–1915. Worcester, Webster, Barre,
field, and Palmer sheets. *See also* pages 135–149 of this report.

Quacumquasit Pond; Worcester County; town of Brookfield; south of Q
Pond (tributary through Quaboag River to Chicopee River and thus to th
necticut) with which it is connected by a northward flowing stream o
mile long. The pond is about 1½ miles long and nearly half a mile in ma
width. Brookfield sheet.

Quaker Brook.—Bristol County; town of Berkley; rises on the northeastern
of Brants Hill; flows southeastward into Forges Pond on Assonet River (tri
through Taunton River to Narragansett Bay); length, 2 miles. Taunton sh

Quakers Run.—Barnstable County; a stream about a mile long flowing sou
ward into Cotuit River 1½ miles west of Cotuit Port. Barnstable sheet.

Quannapowitt Lake.—Middlesex County; just north of Wakefield; inlet,
of Saugus River and another small stream coming in from the west; outlet, S
River, which discharges into Boston Bay; altitude 100 feet above sea
length, about 1 mile; maximum width, about one-half mile. Lawrence she

Queen Brook.—Plymouth County; town of Pembroke; a stream less than
mile long flowing westward into the north end of Furnace Pond. Abington

Queen Sewell Pond.—Barnstable County; town of Bourne; a small pond
between Monument River and Buttermilk Bay; connected by a marsh
Little Buttermilk Bay. Plymouth sheet.

ristol County; city of Fall River; the stream connecting Taunton River (tributary to Narragansett Bay). Fall River

cester County; principal inflowing stream, South Wachusett poxet River (tributary to Wachusett Reservoir); altitude sea level; length, about three-fourths mile; maximum width, Worcester sheet.

ises in Quinapoxet Pond in the northern part of Worcester of Holden, at altitude about 750 feet above sea level; flows es, then northeast and east 3 miles, to Wachusett Reservoir at tributaries, South Wachusett Brook, the main feeder of Asnebumskit Brook, and Trout Brook. Worcester sheet.

ampden and Worcester Counties, Mass., Windham and New Conn.; formed in the town of Brimfield, Hampden County, the headwater stream draining the largest area, receives a ies from the towns of Wales and Holland. Of these smaller Brook is superior by reason of drainage area and is therefore to head of the Quinebaug. Hollow Brook rises on the east slope of flows northward about 4 miles to its junction with Charles point Mill Brook flows eastward and southeastward into the of East Brimfield where it receives a stream that carries the hapaug Pond, Hamilton Reservoir, and Holland Pond; from this flows northeastward to Fiskdale, thence southeasterly through bridge, Southbridge, and Dudley, Mass., southerly through the ndham County, Conn., to Wauregan, thence southwesterly to its etucket River (tributary through Thames River to Long Island above its mouth; length below mouth of Mill Brook, about 60 distance the fall is about 600 feet; average fall below Southbridge, mile. The large number of storage reservoirs and mill ponds water of storms and melting snows and modifies the violence of ater power report of the Tenth Census (p. 201) lists 39 ponds, of Massachusetts. The largest of these ponds (Lake Chaubunagungn area of 1,300 acres. The river is extensively used for power at n Connecticut and Massachusetts. Principal tributaries of the Massachusetts below the mouth of Mill Brook include streams from ar ponds, Hamant, Hobbs, Breakneck, Hatchet, Globe, Cady, on, and Tufts brooks, and French River, which joins the Quinebaug t but drains a considerable area in Massachusetts. Brookfield, am, Moosup, and Norwich sheets. *See also* Reports on the water United States, Tenth Census (1880), vol. 16, pp. 200–212, 1885, in er powers of the Quinebaug and its tributaries are described.

AKE.—Worcester County; an expansion of Quinsigamond River Blackstone River and thus through Seekonk and Providence rivers tt Bay); about 5½ miles long, one-eighth to one-fourth mile wide in rt and one about 1 mile wide in the lower part; altitude, 360 feet el. Worcester, Marlboro, and Blackstone sheets.

IVER.—Worcester County; rises about 1 mile southeast of Boylston e town of Boylston; flows southwestward to Sewell Pond, thence rough Newton Pond to the head of Lake Quinsigamond, from which heastward to Goddard Pond, thence southward to Blackstone River rough Seekonk River to Providence River and thus to Narrangansett herville; length, 14 miles; principal tributaries, Great and South ks, which flow into Lake Quinsigamond. Worcester, Marlboro, and sheets.

Quittacas Ponds.—*See* Great Quittacas and Little Quittacas ponds.

Quivett Creek.—A channel in the marsh east of East Dennis. Yarmouth Wellfleet sheets.

Quostinet River.—Barnstable County; rises at the north end of John Pond; f eastward through a marsh one-half mile, then in general west of south to Waq Bay, through which it is connected with Nantucket Sound; length, about 5 m Falmouth sheet.

Rabbit Pond.—Plymouth County; town of Plymouth; a very small pond lying half mile west of the beach close to the south end of Fresh Pond. Plymouth sh

Ramshorn Brook.—Worcester County; rises 1 mile south of Ramshorn Pond; f northeastward through the pond to West Millbury, thence northwestwar Stoneville, where it enters the pond on Kettle Brook (tributary to Blacks River, and thus through Seekonk and Providence rivers to Narragansett B length, 7 miles. Webster sheet.

Ramshorn Pond.—Worcester County; 1 mile south of West Millbury; outlet, Ra horn Brook to Kettle Brook (tributary to Blackstone River and thus thro Seekonk and Providence rivers to Narragansett Bay). Webster sheet.

Raven Brook.—Plymouth County; rises about 3 miles northeast of Middleb flows northward along the eastern edge of Great Cedar Swamp and discharges Wenatuxet River (tributary through Taunton River to Narragansett Bay) South Halifax; length, about 4 miles. Middleboro sheet.

Rawson Brook.—Berkshire County; rises on Chestnut Hill in the town of Monte flows southwesterly 2½ miles, northwesterly 3 miles to its junction with Konk River (tributary to the Housatonic). Sandisfield sheet.

Red Brook.—Barnstable County, town of Mashpee; a stream about a mile flowing southwestward into one of the eastern arms of Waquoit Bay. Falmo sheet.

Red Brook.—Hampshire County, town of Southampton; rises on the southwest s of Little Mountain; flows southwesterly 1½ miles, thence southeasterly 1 mile Manhan River (tributary to the Connecticut). Springfield sheet.

Red Brook.—Plymouth and Barnstable counties; rises in White Island P flows irregularly southward and discharges into Buttermilk Bay at the hea Cohasset Narrows, Buzzards Bay; length, about 4 miles. For 2 miles ab Buttermilk Bay, Red Brook is on the boundary between the towns of Warel and Plymouth. Plymouth sheet.

Red River.—Barnstable County; a channel in the marsh southeast of South wich. Yarmouth sheet.

Reed Brook.—Berkshire County; a stream about a mile long, flowing westward Tophet Brook (tributary through Hoosic River to the Hudson) in the tow Adams. Greylock sheet.

Reed Pond.—Nantucket County, Nantucket Island, northwest of the city of tucket; a very small pond less than one-eighth mile back from the beach. tucket sheet.

Reedy Meadow Brook.—Middlesex County; rises in a swamp about 2½ miles so east of Pepperell; flows northward into Nashua River (tributary to the Merrima Groton sheet.

Reservoir Marsh Pond.—Norfolk County; 1½ miles north of Wrentham; on River (tributary to Charles River). Franklin sheet.

Reservoir Pond.—Bristol County, town of North Attleboro; west of Attleboro and Robinsonville; inflowing stream passes through a pond above North Attleb outlet to Tenmile River and thus to Narragansett Bay. Providence sheet.

Reservoir Pond.—Norfolk County, town of Canton; principal inlet, a stream flo through the marsh in the eastern part of the township; outlet, a stream one- mile long flowing from the west end southward into the pond on Canton Riv Canton. Dedham sheet.

.—Worcester and Middlesex counties; storage reservoirs in
onstructed by the city of Boston and the Metropolitan Water
. *See* Sudbury River and Concord River. Marlboro and

County; rises about 1 mile northwest of Lynn, at altitude
vel; flows southwestward one-half mile into Breeds Pond, and
ward for 1 mile into Saugus River, which discharges into
al tributary, stream draining Birch Pond. Boston and Bos-

ı County; town of Charlemont; rises northeast of Legate Hill;
3½ miles into Deerfield River (tributary to the Connecticut)
awley sheet.

-Middlesex County; formed by the junction of Potash Brook
brook about 1½ miles north of Centralville, at altitude 100 feet
ows southeastward 1 mile into Trout Brook (tributary to the
h Brook is considered the head of Richardson Brook. Lowell

-Middlesex County; about 2½ miles west of Wakefield; inlet,
let, Aberjona River, and thus through Mystic lakes and Mystic
ay; altitude, 60 feet above sea level; length, about one-half mile;
less than one-fourth mile. Lawrence sheet.

erkshire County; towns of Pittsfield and Richmond; several
; outlet, Housatonic Branch (tributary through West Branch of
r to the Housatonic); one-half mile wide; three-fourths mile long.

ok.—Middlesex County; rises about three-fourths mile southeast
ltitude 220 feet above sea level; flows northeastward 4½ miles,
Tophet Swamp, northwestward 1 mile, and again northeastward
ourse for 5 miles to its junction with Concord River (tributary to
at Lowell; fall from source to mouth, 120 feet; principal tributaries,
Meadow, Farley, Putnam, Beaver, and Golden Cove brooks.

-Berkshire County; rises near Washington village in the town of
ows northwestward to its junction with Housatonic River in the
; about 5 miles long; passes through Clapp Pond. Becket sheet.

-Bristol County; a stream about 2 miles long flowing in general
into New Bedford Reservoir (unused) at the head of Acushnet
ry to New Bedford Harbor). Middleboro sheet.

-Franklin County; rises in the town of Conway 2 miles southwest of
Conway; flows southeasterly 5 miles to its junction with Mill River
the Connecticut); principal tributary, Popple Hill Brook. North-

.—Franklin County; town of Shutesbury. *See* Mill River.

.—Hampden and Hampshire counties; rises in the town of Chester,
ıwest of Chester Center; flows southeasterly 5 miles to its junction
st Branch of Westfield River (tributary through Westfield River to
icut). Chesterfield and Granville sheets.

.—Hampshire and Hampden counties; rises on Norwich Hill in the
ntington; flows southwesterly 5 miles to its junction with Westfield
ıtary to the Connecticut). Chesterfield and Granville sheets.

-Plymouth County; a pond one-half mile wide by one-sixteenth mile
4 miles east by north from Bridgewater; inlet, from Stump Pond; out-
ard to Satucket River (tributary through Matfield River to Taunton
thus to Narragansett Bay). Abington sheet.

Robbins Pond.—Barnstable County; one-half mile northeast of North Ha Yarmouth sheet.

Robbins Pond.—Middlesex County; a small, marshy pond about 1½ miles sout of Ayer, discharging by a stream 1½ miles long flowing northward into Nona Brook (tributary through Nashua River to the Merrimack). Groton sheet.

Robert Meadow Brook.—Hampshire County; rises 2 miles southwest of Battl Hill; flows southeastward 3 miles into Roberts Brook (tributary througl River to the Connecticut). Chesterfield sheet.

Roberts Brook.—Hampshire County; rises on the south slope of Battlecock flows southeastward 4 miles, thence northeastward 3 miles into Mill River utary to the Connecticut) at Leeds; principal tributary, Robert Meadow Chesterfield and Northampton sheets.

Robinson Brook.—Middlesex County; rises 1½ miles northeast of Townsend H flows west of south 1 mile, then southeastward 2 miles into Nashua River (tri to the Merrimack); tributary, Bancroft Brook. Groton sheet.

Robinson Creek.—Plymouth County; rises on the west slope of Long Hill, town of Marshfield; flows circuitously westward into North River; about 2 long. Abington sheet.

Rochdale Pond.—Worcester County; just north of the village of Rochdale; on F River (tributary through Quinebaug River to Shetucket River, and thus th Thames River to Long Island Sound). Webster sheet.

Roche Run.—Plymouth County; town of Hanson; a stream about one-half mile flowing northward into Indian Head River (tributary to North River). A ton sheet.

Rock Creek.—Barnstable County; a channel in the marsh north of Rock H Wellfleet sheet.

Rock Meadow Brook.—Worcester County; rises on the south slope of Miscoe flows southwestward 3½ miles into West River (tributary to Blackstone Rive thus through Seekonk and Providence rivers to Narragansett Bay). Blac sheet.

Rock Pond.—Essex County; just west of Georgetown; inlet, Parker River; c Parker River (tributary to Plum Island River, and thus to the Atlantic C through Pentucket Pond; length, one-half mile; maximum width, abou fourth mile; altitude, 100 feet above sea level. Lawrence sheet.

Rocky Brook.—Worcester County; rises on the east slope of Justice Hill, at al 770 feet above sea level; flows east of south 2 miles, then southwestward into Stillwater River (tributary to Wachusett Reservoir). Worcester sheet.

Rocky Gutter Brook, East.—Plymouth County; rises in the swamp north of Middleboro; flows southward 2 miles and unites with West Rocky Meadow to form Double Brook (tributary to Weweantic River and thus to Buzzards Middleboro sheet.

Rocky Gutter Brook, West.—*See* Double Brook.

Rocky Meadow Brook.—Plymouth County; rises 3 miles west of the vill Carver; flows southwestward 1 mile, then southeastward about 2 mile Weweantic River (tributary to Buzzards Bay) below the mouth of Beaver Brook. Middleboro sheet.

Rocky Pond.—Plymouth County; town of Plymouth; south of Clew Pond. mouth sheet.

Rocky Pond.—Plymouth County; town of Plymouth; three-fourths mile e north end of White Island Pond. Plymouth sheet.

Rocky Pond.—Worcester County; 3 miles northwest of Northboro; outlet, a s about 1 mile long flowing westward and then southeastward into Cold B Brook (tributary through Assabet River to the Concord and thus to the Merri Marlboro sheet.

· **County;** southeast of Bald Hill; outlet, a stream 1 mile
ıtward into the reservoir at the head of Monoosnoc Brook
ırth Branch of Nashua River to Nashua River and thus to the
urg sheet.

ristol County; town of Rehoboth; rises 1 mile east of Bad
southwestward about 6 miles, then northwestward and west-
'arren River (tributary to Narragansett Bay). Taunton and

ɔshire County; town of Goshen; rises a mile south of More
tward 3 miles into Mill Brook (the head of the West Branch
ıtary through Mill River to the Connecticut). Chesterfield

ɜ County; a small pond in the southwestern part of the town of
mile northeast of South Egremont. Sheffield sheet.

ıth County; town of Wareham; a stream about 3 miles long,
:h into Wareham River (tributary to Buzzards Bay) at Ware-
mouth sheet.

ıuth County; town of Plymouth; a small pond 1 mile northeast
ırth of Clear Pond; south of Old Colony Railroad line. Ply-

ıoᴋ.—Worcester County; town of Mendon; a stream 1½ miles
ɛastward into Mill River (tributary to Blackstone River and thus
and Providence rivers to Narragansett Bay). Blackstone sheet.

ıtable County; town of Barnstable; 2 miles west of Great Pond.

stable County; town of Wellfleet; one of a group of small pond
village of Wellfleet. Wellfleet sheet.

:shire County; a very small pond in town of Great Barrington;
ɜst of Van Deusenville. Sheffield sheet.

x County; 2½ miles northwest of Manchester; inlets, small streams
Coys ponds; outlet, a small stream to Chebacco Lake and thus to
ıtitude, 60 feet above sea level; length, about one-half mile;
ı, less than one-fourth mile. Salem sheet.

ex County; a small pond just north of Haverhill, 1 mile north of
er; altitude, 160 feet above sea level. Haverhill sheet.

'mouth County; town of Plymouth; one of a group of small ponds
tral part of the township. Plymouth sheet.

Essex County; a tidewater channel flowing from the junction of
l Muddy Run, about three-fourths mile east of Rowley, northeast-
:hrough the swamps into Plum Island River (separated from the
ı by Plum Island). Salem sheet.

—Franklin County; a stream a mile long flowing southeastward into
(tributary through Deerfield River to the Connecticut) west of
ı. Hawley sheet.

'kshire County; town of Becket; a mile northwest of Becket Center;
ıward flowing stream (tributary to a stream that enters West Branch
River which discharges to the Connecticut through Westfield River)
Becket sheet.

—Norfolk County; a stream about 1½ miles long, tidal in its lower
ʒ Weymouth Fore River north of Quincy Neck. Abington sheet.

.—Norfolk and Bristol counties; rises in Billings Pond in the town
ows irregularly southward to Norton Reservoir, then southeastward
on with Wading River to form Threemile River (tributary through
ver to Narragansett Bay); length, 14 miles; passes through a number
ds. Dedham and Taunton sheets.

Run Brook.—Middlesex County; rises in a swamp 2 miles south of Mayn altitude 180 feet above sea level; flows eastward through Willis Pond, the erally southward into Hop Brook (tributary through Wash Brook to Su River and thus through Concord River to the Merrimack); length, 1½ Framingham sheet.

Running Gutter Brook.—Hampshire County; rises on the south slope of Ch Hill; flows in general southeasterly 3 miles, then north of east one-half mi Mill River (tributary to the Connecticut); principal tributary, Broad Northampton sheet.

Runnins River.—Bristol County, Mass., and Providence County, R. I.; rises southwest slope of Great Rock in the town of Rehoboth; winds very irreg southwestward to Seekonk, thence southeastward along the Massachusetts- Island boundary 3 miles to Harrington River, through which it dischar Warren River and thus to Narragansett Bay; length, 8 miles. Providence

Run Pond.—Barnstable County; town of Dennis; 1½ miles south of Scargo Yarmouth sheet.

Russell Pond.—Plymouth County; town of Kingston; on Smelt Brook (trib to Jones River, which discharges into Massachusetts Bay through Kingston near mouth. Plymouth sheet.

Russ Pond.—Hampshire County; town of Prescott; a very small pond lying west base of Russ Mountain and discharging by a stream flowing southwar southeastward into the Middle Branch or head of Swift River (tributary th Ware River to Chicopee River and thus to the Connecticut). Belche sheet.

Rutland Brook.—Worcester County; rises one mile southwest of Hawes Hill town of Barre, and flows northwestward 2 miles and southwestward 1 mile in East Branch of Swift River (tributary through Swift River to Ware River an through Chicopee River to the Connecticut). Barre sheet.

Sabrina Lake.—Norfolk County; about 1½ miles east of South Natick and on mile east of Charles River which is here flowing southward. Framingham

Sachem Brook.—Berkshire County; town of Lanesboro; rises between The N and Potter Mountain; flows west and south 3½ miles, then southeastward on mile into the northwestern arm of Pontoosuc Lake; outlet, west branch of tonic River to Housatonic River; principal tributary, Hollow Brook. (reprint 1908) and Greylock sheets.

Sacker Brook.—Middlesex County; rises about 1½ miles southwest of Pepper altitude 310 feet above sea level; flows in a general northerly direction 3 into Nissitisset River (tributary through Nashua River to the Merrima mile west of North Village. Groton sheet.

Sackett Brook.—Berkshire County; rises in the town of Washington, a mile n Ashley Lake and 2½ miles northwest of Washington Station; flows northwe 3 miles, then south of west 2 miles into Housatonic River; principal trib Ashley Brook. Water is used for part of municipal supply of city of Pitt Becket sheet.

Salisbury Plain River.—Norfolk and Plymouth counties; rises in the s northeast of Stoughton; flows southeasterly to a point near East Bridgewater, it united with Beaver Brook and below which it is called Matfield River Matfield River. Called Saulsbury Brook between Brockton reservoir and ton. Dedham and Abington sheets.

Salmon Brook, East Branch.—Hampden County, Mass., Hartford County, rises on the eastern slope of South Mountain, in the southeastern part of the of Granville; flows southeasterly to the southeastern part of Granby in Ha County, Conn., where it enters Salmon Brook (tributary through Farmington to the Connecticut.) Only about a mile of the head of this brook is in chusetts. Granville sheet.

ro County, N. H., and Middlesex County, Mass.; rises on
ke Hill, 2 miles northeast of Ayer, at altitude 320 feet above
astward through Cow Pond Meadows, Cow Pond, and Massa-
ction with Merrimack River near Nashua, N. H.; principal
Pond Brook; Baddacook Brook, and Black and Jointgrass
ond Brook above Massapoag ponds; length from Martins Pond
about 15 miles; fall in the 8 miles below Lower Massapoag
on, Lowell, and Manchester sheets.

County; town of Falmouth; southwest of the city of Fal-
t stream flowing southward into Vineyard Sound. Falmouth

County; town of Plymouth; in the marsh one-half mile north
lischarges into the Bay through a short southward flowing
sheet.

nouth County; rises in the western part of the town of Ply-
westward into Weweantic River (tributary to Buzzards Bay)
west of South Carver; principal tributaries, streams from Fed-
ponds; length, about 7 miles. Plymouth and Middleboro

mouth County; town of Kingston; rises in the northeastern part
ws southward into Blackwater Pond on Halls Brook (tributary
er to Kingston Bay, a branch of Massachusetts Bay). Duxbury

nouth County; town of Carver; principal inflowing stream, Till-
a stream nearly a mile long flowing southeastward into Sampson
through Weweantic River to Buzzards Bay). Plymouth and
s.

ster County; rises about 1 mile southeast of Fitchburg at alti-
ove sea level; flows northward into North Branch of Nashua
through Nashua River to the Merrimack) between Fitchburg
urg; length, about 2 miles. Fitchburg sheet.

ranklin County; rises in the southeastern corner of Whittington,
y, Vt., flows southeastward 3 miles into West Branch of North
through North River to Deerfield River and thus to the Con-
ley sheet.

—Hampden County; rises a mile southwest of Green Hill; flows
miles, then northeastward 1½ miles into West Branch of Westfield
through Westfield River to the Connecticut). Granville and
ets.

table County; one-fourth mile south of North Harwich; outlet, a
rths mile long flowing southward into Herring River (tributary
ound). Yarmouth sheet.

erkshire County, Mass., Litchfield County, Conn.; rises 2 miles
uth Sandisfield; flows southeasterly 12 miles to its junction with
utary through Farmington River to the Connecticut) near Rob-
e town of Colebrook; length above Massachusetts line, about 4
field sheet.

ddlesex County; one-half mile northwest of Lincoln; no inlets
t, Stony Brook to Charles River; altitude about 230 feet above sea
mile long. Framingham sheet.

ddlesex County; 1½ miles east of Ayer; inlet, from Long Pond;
pond south of Ayer to Nonacoicus Brook (tributary through Nashua
Merrimack). Groton sheet.

Sandy Pond.—Plymouth County; town of Plymouth; one-fourth mile east of W Island Pond. Plymouth sheet.

Sandy Pond.—Watuppa Basin, Fall River. *See* Sawdy Pond.

Santuit Pond.—Barnstable County; 1 mile north of the village of Cotuit; ou Cotuit River to Poponesset Bay, and thus to Nantucket Sound. Barnst sheet.

Sassaquin Pond.—Bristol County; town of New Bedford; outlet, Pamanset Riv Slocums River and thus to Buzzards Bay. New Bedford sheet.•

Satucket River.—Plymouth County; formed in the town of East Bridgewater by union of Poor Meadow Brook and the stream flowing from Robbin Pond, w receives the overflow from Monponset and Stump ponds and the Great C Swamp in the town of Halifax. Poor Meadow Brook, which drains the l area, is a continuation of Shumatuscacant River, which rises near North Al ton and flows southeastward 7 miles to the junction; Poor Meadow Brook flows west of south 3½ miles to the point at which it receives the stream Robbin Pond; from this point Satucket River flows northwestward 2½ m thence southwestward and southward 2 miles into Matfield River (tributary thr Taunton River to Narragansett Bay). The length of Satucket River from the of Shumatuscacant River to Matfield River is about 15 miles. Abington she

Saugus River.—Essex and Middlesex counties; rises in the city of Readin altitude 100 feet above sea level; flows south of east 2 miles into Quannap Lake, from which it flows eastward 2 miles into a swamp and then takes a ge course southeastward for about 10 miles into Boston Bay at Lynn Harbor; pr pal tributaries, Beaver Dam, Hawkes, Revere, and Stony brooks; passes thr Prankers Pond; marshy throughout much of its course; Boston, Boston Ha and Lawrence sheets.

Saulsbury Brook.—*See* Salisbury Plain River.

Savery Pond.—Plymouth County; town of Plymouth; 1½ miles southwest of C Hill Point and a mile west of the beach. Plymouth sheet.

Sawdy Pond.—Bristol County; south of South Watuppa Pond into which it charges; principal inlet, a stream from Devol Pond. Fall River sheet. *Se* Report of the Reservoir Commission to the city council of Fall River, Mass., J 1902. Called Sandy Pond on the map.

Saw Mill Brook.—Hampshire County; rises on the northeast slope of Bald flows northeastward 1 mile, southeastward 2½ miles to West Farms, then ward and southeastward 4 miles into Manhan River (tributary to the Connect at Easthampton; drains also the west slope of Saw Mill Hills. Northam sheet.

Saw Mill Brook.—Middlesex County; rises about one-fourth mile north of Pu tasset Hill, about 2 miles north of Concord, at altitude 160 feet above sea l flows southeastward about three-fourths mile into Concord River (tribu to the Merrimack); marshy near its mouth. Framingham sheet.

Saw Mill Brook.—Plymouth County; town of Bridgewater; rises about a mile s of the city of Bridgewater; flows in general west of south into Taunton F (tributary to Narragansett Bay) near Titicut; length, 3 miles. Middle sheet.

Saw Mill River.—Franklin County; towns of Leverett and Montague; rises 1½ southeast of village of Dudleyville; flows northwestward 9 miles, then south ward 1½ miles into the Connecticut; principal tributary, stream from Lock P and Goddard and Pond brooks. Belchertown, Warwick, and Greenfield sh

Sawyer Pond.—Franklin County, town of Northfield; north of Mount Her inlet and outlet, Bennett Brook (tributary to Connecticut River). War sheet.

ıpden County; rises in the northern part of the town of Staf-
ıorthwestward 5 miles to Hampden, Mass., then southwesterly
·ly 6 miles to North Somers, Conn., where it joins Whatchaug
.ntic River (tributary to the Connecticut); length above the
, about 8 miles; principal tributaries in Massachusetts, Big and
mer sheet.

ıtable County; town of Dennis; west and north of Scargo Hill
le south of Nobscusset Harbor. Yarmouth sheet.

ldlesex County; a stream about a mile long, rising in the swampy
k Pond, 3 miles northwest of Lowell, and flowing southward
iver. Lowell sheet.

tchfield County, Conn.; Berkshire County, Mass.; rises in Twin
n of Salisbury, Conn.; flows in general northeasterly to Sheffield,
ıters Housatonic River; length, about 8 miles, of which nearly 7
the Massachusetts-Connecticut boundary line; principal tribu-
Hubbard brooks. The lakes at the head are large and rather
ne, that from which the stream flows being in general long and
t its southern end, and the other being roughly circular in out-
heet.

—Barnstable County; three-fourths mile southwest of Brewster;
flowing northwestward through Freemans Pond into Cape Cod
sheet.

nouth County; town of Plymouth; a small pond lying one-eighth
the shore about half way between Manomet and Stage points.

.

ɜarnstable County; a tidal channel in the Great Marshes west of
ɔor; Barnstable sheet.

꞉REEK.—Barnstable County; town of Sandwich; a tidal channel
ɜtween East Sandwich station and Scorton Neck; connects with
ıarnstable sheet.

rcester County; flows from Scott Reservoir into Baker Brook (tribu-
orth Branch of Nashua River to Nashua River, and thus to the
ngth, about 1½ miles. Fitchburg sheet.

–Worcester County; 2½ miles northwest of Fitchburg; outflowing
rook (tributary to Baker Brook and thus, through North Branch of
ıshua rivers, to the Merrimack). Fitchburg sheet.

Bristol County; town of Taunton; 3 miles north of the city of
, Mill River; outlet, Mill River to Taunton River (tributary to
ay). Taunton sheet.

nstable County; south of Follins Pond on Bass River; connected
ɜay on Bass River by a short channel. Yarmouth sheet.

Franklin County; town of Buckland; a stream a mile long, flowing
ıto Deerfield River (tributary to the Connecticut) about a mile east
ıf First Brook. Hawley sheet.

Franklin County; town of Whately; a stream less than a mile long
ıastward into Connecticut River. Northampton sheet.

Plymouth County; town of Kingston; a stream about three-fourths
ing northwestward into Jones River 1 mile below mouth of Furnace
ıouth sheet.

BROOK.—Plymouth County; rises on the south slope of Mount Bluet
l Swamp; flows southeastward into North River in the town of Nor-
3 miles. Abington sheet.

Second Pond.—Hampden County; town of Ludlow; southeast of Ludlow City; let, a stream flowing north and west into Stony Brook (tributary to the C necticut); very small. Palmer sheet.

Seekonk Brook.—Berkshire County; rises near West Stockbridge Center; flows so westerly 2½ miles, then somewhat east of south 6 miles to the southwestern of the town of Great Barrington, where it joins Green River (tributary to Housatonic). Pittsfield and Sheffield sheets.

Segreganset River.—Bristol County; town of Dighton; rises about 2 miles ea North Rehoboth; flows southeastward 7 miles to its junction with Taunton R (tributary to Narragansett Bay) north of Dighton; principal tributary, Sur Brook. Taunton sheet.

Sengekontacket Pond.—Dukes County; Marthas Vineyard; a tidal pond paralle Vineyard Sound between Cottage City and Edgartown; separated from the so by a narrow beach. Marthas Vineyard sheet.

Sesachacha Pond.—Nantucket County; Nantucket Island; east shore; a large p south of Quidnet village; separated from the ocean by a narrow beach. N tucket sheet.

Sessions Brook.—Worcester and Hampden counties; rises in the town of War flows southward 2½ miles into East Brook (tributary through Mill Brook to Qu baug River and thus through Shetucket River to Thames River and Long Isl Sound). Brookfield sheet.

Sesuit Creek.—Barnstable County; town of Dennis; a channel in the tidal m west of East Dennis. Yarmouth and Wellfleet sheets.

Sevenmile River.—Norfolk and Bristol counties; rises in the town of Wrenth Norfolk County; flows southeastward 4 miles, thence in general west of sou miles to its junction with Tenmile River (tributary through Seekonk Rive Providence River and thus to Narragansett Bay) near Lebanon Mills; princ tributary, Fourmile Brook. Providence sheet.

Sevenmile River.—Worcester County; considered the head of Quaboag River, c

Sewell Pond.—Worcester County; town of Boylston; a small pond near the hea Quinsigamond River (tributary through Blackstone River to Seekonk River thus through Providence River to Narragansett Bay), which flows through Newton Pond. Marlboro sheet.

Seymour Brook.—Hampden County; rises in the southern part of the town of G ville; flows southeastward to the west base of South Mountain, then northe ward to its junction with Dickinson Brook (the head of Munn Brook, whic tributary through Westfield Little River to Westfield River and thus to Connecticut); length, 2 miles. Granville sheet.

Seymour Pond.—Barnstable County; west of Long Pond and north of Hinckleys P altitude, about 20 feet above sea level; one-half mile long. Yarmouth sheet.

Shaker Brook.—Berkshire County; a stream 1½ miles long, rising in the southeas part of the town of Hancock and flowing southeastward into Housatonic Br (tributary through west branch of the Housatonic to the Housatonic) just b the outlet of Richmond Pond. Pittsfield sheet.

Shaker Mill Pond.—Berkshire County; northern part of the town of West St bridge; principal inflowing streams, Cone Brook, Griffin Brook, and Flat Br outlet, Williams River to Housatonic River. Pittsfield sheet.

Shallow Pond.—Barnstable County; town of Barnstable; east of the north ha Great Pond, from which it is separated on the west by a narrow ridge. Barnst sheet.

Shallow Pond.—Barnstable County; town of Falmouth; one of a group of p lying northwest of East Falmouth. Falmouth sheet.

Shallow Pond.—Plymouth County; town of Plymouth; 1½ miles south of the end of Beaver Dam Pond. Plymouth sheet.

Barnstable County; in the marsh one-half mile west of
ncetown sheet.
mpden County; rises in Shatterack Pond, in the town of
ıthwestward 2 miles into Westfield River (tributary to the
ille sheet.
npden County; 1 mile west of Montgomery; outlet, Shat-
stfield River (tributary to the Connecticut). Granville

dham County, Vt., Franklin County, Mass.; rises in the
the town of Guilford, Vt.; flows southeasterly 3 miles to
he town of Leyden, Mass., then somewhat south of east 2
ıardston, where it joins Falls River (tributary to the Con-
oro and Greenfield sheets.
rcester County; head of East Branch of Swift River. *See*

nouth County; town of Middleboro; a stream about a mile
f south into Fall Brook (tributary through Namasket River
nd thus to Narragansett Bay). Middleboro sheet.
ter County; rises in Shaw Pond in the town of Leicester; flows
miles, then westward 1 mile to Wire Village, where it enters
(tributary through Sevenmile River to East Brookfield River
Quaboag River to Chicopee River and the Connecticut). Wor-

ire County; 2 miles northwest of North Otis; two inflowing
stream three-fourths mile long flowing southeastward into
r (tributary to the Connecticut): about a mile long and one-
Becket and Sandisfield sheets.
ster County; town of Leicester; outlet, Shaw Brook to Turkey
utary through Sevenmile River to East Brookfield River and
aboag River to Chicopee River and the Connecticut). Worces-

—Middlesex and Essex counties; rises 1 mile west of Lexington,
feet above sea level; flows generally northward about 4 miles,
ard about 18 miles into Merrimack River at North Andover;
ction passes through a pond, unnamed on the map, on the south
Hill; marshy through most of its course; principal tributaries,
e, Spring, Webb, Wright, Content, Heath, and Strongwater brooks.
owell, and Lawrence sheets.
mpden County; a small pond 1 mile northwest of Ludlow and north
ver (tributary to the Connecticut). Palmer sheet.
nstable County; near South Brewster; one-half mile north of Long
uth sheet.
—Norfolk County; rises about 2 miles northeast of Franklin, at
et above sea level; flows northwestward 2½ miles into Charles River.
t.
—Norfolk County; 3 miles northeast of North Attleboro; principal
am drains the northeastern part of the town of Wrentham; outlet,
e-fourths mile long flowing eastward to Wading River (head of
ver, which is tributary through Tauton River to Narragansett Bay).
et.
ESERVOIR.—Norfolk County; a large pond about 1½ miles north of
boro; two inflowing streams; natural outlet via Shepards pond.
et.

Shepherd Brook.—Franklin County; town of Buckland; a stream 1½ mil flowing southeastward along the east base of Hog Mountain into Clesson (tributary through Deerfield River to the Connecticut). Hawley sheet.

Shingle Brook.—Franklin County; rises on the east slope of Brimstone Hil west of south 3 miles into Deerfield River (tributary to the Conne Greenfield sheet.

Shingle Island River. *See* Westport River, of which it is the head.

Shingle Swamp Brook.—Franklin County; rises 1½ miles southwest of Eag flows northeastward 3 miles into Millers River (tributary to the Conne Warwick sheet.

Ship Pond.—Plymouth County; town of Plymouth; 1 mile northwest of Cent Point; separated from Cape Cod Bay by a sand bar. Plymouth sheet.

Shirley Reservoir.—Worcester and Middlesex counties; 1½ miles north Shirley Village; through Catacoonamug Brook receives the waters of Un whatong, Dead, and Massapoag ponds; outflowing stream passes through small ponds and discharges into Nashua River (tributary to the Merrimac half mile east of Shirley Village, Middlesex County; altitude about 320 fee sea level; altitude of outflowing stream at entrance to Nashua River ab feet above sea level. Groton sheet.

Shivericks Pond.—Barnstable County; near the city of Falmouth; small. Fa sheet.

Shorts Brook. Plymouth County, town of Middleboro. *See* Fall Brook.

Shubael Pond.—Barnstable County; town of Barnstable; 2 miles west of Grea Barnstable sheet.

Shumatuscacant River. *See* Satucket River.

Sibley Reservoir.—Worcester County; 1 mile north of the village of outlet, a stream flowing eastward into Cold Spring Brook (tributary t Blackstone River to Seekonk River and thus through Providence R Narragansett Bay). Webster sheet.

Silver Brook.—Berkshire County; town of Sandisfield; rises northwest of Hill; flows southeasterly 4 miles, then northeasterly 1 mile to West New where it joins Clam River (tributary through Farmington River to the Co cut). Sandisfield sheet.

Silver Brook.—Plymouth County; town of Hanover; a stream about 1½ mil flowing northeastward and entering Third Herring Brook (tributary to River) 2 miles below Jacob Pond. Abington sheet.

Silver Brook.—Worcester County; rises 1 mile north of Ridge Hill; flows nor 2 miles into East Branch of Swift River (tributary through Swift River t River and thus through Chicopee River to the Connecticut). Barre sheet

Silver Lake.—Berkshire County; in Pittsfield; outlet, a very short stream southward into Housatonic River. Becket sheet.

Silver Lake.—Middlesex County; a small pond 1 mile west of Wilmington C short distance west of Lubber Brook (tributary to Ipswich River); altitud 90 feet above sea level. Lawrence sheet.

Silver Lake.—Plymouth County; inlet, Tubbs Meadow Brook (considered Jones River); natural outlet, Jones River to Kingston Bay; lake is about long by one-half mile wide, and is used as a source of municipal supply city of Brockton. Abington sheet.

Silver Lake.—Worcester County; town of Grafton; inlet, Miscoe Brook (head River); outlet, West River to Blackstone River (tributary through S River to Providence River and thus to Narragansett Bay). Blackstone s

Simmons Ponds.—Barnstable County; town of Dennis; two small ponds 1 southeast of Scargo Hill. Yarmouth sheet.

ounty; extreme southeastern part of the town of Sandis-
ing streams; outlet, a stream 1½ miles long flowing north
ad of Farmington River (tributary to the Connecticut)

cester County; rises 1 mile north of West Sutton; flows
Singletary Pond into Blackstone River (tributary through
vidence River and thus to Narragansett Bay) at Millbury;
Vebster sheet.

ester County; a mile northwest of Sutton; inlet and outlet,
ibutary to Blackstone River and thus through Seekonk
River and Narragansett Bay); 1½ miles long; one-half mile

ex County; a very small pond about one-half mile west of
mile west of Assabet River (tributary through Concord River
ltitude 160 feet above sea level. Framingham sheet.

RANCH.—Plymouth County; rises 1 mile northeast of South
outheastward 2½ miles, southward 3 miles, then southwest-
e head of Leonards Pond, where it unites with West Branch
iver (tributary through Weweantic River to Buzzards Bay).

outh County; formed in the town of Rochester by the union
st branches. The West Branch, which drains the larger area,
nsidered the continuation of the river, rises one-half mile
Middleboro and flows southeasterly to Leonards Pond, where
st Branch; passing through Leonards Pond the river flows east
les, then very irregularly eastward to its junction with Wewean-
ry to Buzzards Bay); length to head of West Branch, 10 miles;
ies below East Branch, Doggetts Brook, and Hammond Brook.
ew Bedford sheets.

T BRANCH. *See* Sippicon River.

heshire County, N. H., and Worcester County, Mass.; a stream
flowing in a general southerly direction from Sip Pond in the
iam, N. H., to Millers River (tributary to the Connecticut) 2
inchendon; principal tributaries, a stream one-half mile long
onds near State Line, N. H., and a stream 3 miles long from
in the town of Rindge, N. H.). Winchendon sheet.

Barnstable County; at South Harwich. Yarmouth sheet.

x and Middlesex counties; rises in a swamp on the south slope of
t Hill, about 1½ miles southeast of Andover, at altitude 180 feet
; flows southward 3½ miles, then westward through a swamp for
artins Pond (head of Martins Brook, which is tributary to Ipswich
nce sheet.

npden County; name is applied to two brooks, both tributary to
tributary through Westfield River to the Connecticut) within a
ger of these streams rises 1½ miles northwest of Southwick Hill; the
er is half a mile north of Round Hill; both streams flow easterly; the
t 2½ miles long and the shorter less than 2 miles. Granville and
eets.

IR.—Worcester County; town of Charlton; on Little River (tributary
ch River to Quinebaug River and thus through Shetucket and
rs to Long Island Sound). Webster sheet.

-Hampden County; rises in Cranberry Pond, in the southeastern
wn of Tolland; flows southwesterly 4 miles to its junction with the
River (tributary to the Connecticut) in the northeastern part of
onn. Sandisfield sheet.

Slocums River.—Bristol County; town of Dartmouth; an arm of Buzza between Slocums Neck and Smiths Neck; principal tributary, Pamanse tidal. New Bedford sheet.

Slough Bond.—Barnstable County; town of Wellfleet; one of a group of ponc east of Wellfleet village; outlet, through Herring Pond and Herring Wellfleet Harbor, Cape Cod Bay. Wellfleet sheet.

Sluice Brook.—Franklin County; town of Shelburne; rises on The Patten northeast of Bald Mountain; flows southward 3 miles into Deerfield Rive tary to the Connecticut), 2 miles below Shelburne Falls. Greenfield sh

Small Brook.—Hampden County; rises in a small pond 1 mile north of M Hill; flows northwestward 1 mile, then northward 1 mile into the South of Mill River (tributary through Mill River to the Connecticut). Sp sheet.

Small Pond.—Barnstable County; 2½ miles north of Hyannis; west of sout Israels Pond. Barnstable sheet.

Smead Brook.—Franklin County; a stream 2 miles long flowing eastward in River (tributary through Deerfield River to the Connecticut) at Gr Greenfield sheet.

Smelt Brook.—Plymouth County; town of Kingston; rises in Little Sme flows northwestward into Smelt Pond, then in general northeastward in River (tributary through Kingston Bay to Massachusetts Bay) one-h above its mouth; length, 2½ miles. Plymouth sheet.

Smelt Pond.—Plymouth County; town of Kingston; inlet from Little Sme outlet, Smelt Brook to Jones River (tributary through Kingston Bay t chusetts Bay). Plymouth sheet.

Smith Brook.—Berkshire County; rises on Tower Mountain in the town of and flows southeastward 4 miles into Housatonic Branch (tributary thro branch of Housatonic River to the Housatonic) one-half mile northeast Barkerville. Pittsfield sheet.

Smith Brook.—Berkshire County; town of Florida; a stream about 1½ mi flowing southeastward into Deerfield River (tributary to the Connectic northeastern part of the town. Hawley sheet.

Smith Brook.—Worcester County; town of Barre; a stream 1½ miles long southeastward into Prince River (tributary through Ware River to River and thus to the Connecticut). Barre sheet.

Snake Pond.—Barnstable County; town of Sandwich; one-half mile west Dale. Falmouth sheet.

Snipatuit Pond.—Plymouth County; 1½ miles southeast of Great Quittac outlet, Mattapoisett River to Buzzards Bay; a large pond containing seve islands. Middleboro sheet.

Snows Pond.—Barnstable County; a small pond 2 miles north of the village fleet. Wellfleet sheet.

Snows Pond.—Plymouth County; town of Rochester; three-fourths mile sou the southern end of Snipatuit Pond. Middleboro sheet.

Sodden Brook.—Hampshire County; rises on the east slope of Red Oak Hi northeastward 3 miles, then eastward three-fourths mile into North B Manhan River (tributary through Manhan River to the Connecticut). field sheet.

Solomon Pond.—Worcester County; a small pond 2 miles northeast of Northb half mile west of Assabet River (tributary through Concord River to th mack). Marlboro sheet.

Sought For Pond.—Middlesex County; 2 miles northwest of Westford stati let, Spaulding Brook to Keyes Pond and thus through Keyes Brook an Brook to the Merrimack; altitude, about 200 feet above sea level; lengt three-fourths mile; maximum width, one-half mile.

Rises in the northern part of Worcester County, Mass., in Stodge-
the north slope of Mount Hunger, at altitude 1,110 feet above
a general northeasterly direction to Wilton, N. H., where it is
Brook, then eastward to its junction with Merrimack River at
., length, about 30 miles. Only a small part of the area drained
er lies in Massachusetts.

stream is very large and its bed and banks are rocky. It
power sites.

precipitation in this basin, about 42 inches; average depth of
ry and February, about 18 inches. Gaging station at Merrimack,
. Fitchburg and Peterboro sheets.

e significant name.

kshire County; rises between North Mountain and Weston Moun-
n of Dalton; flows east of north 1½ miles, then northwestward 2
e, where it enters Hoosic River (tributary to the Hudson). Grey-

mouth County; town of Bridgewater; rises just west of the city
flows southeastward 1 mile, irregularly northeastward 2 miles,
th 1 mile into Town River (tributary through Matfield to Taunton
to Narragansett Bay). Middleboro sheet.

ESERVOIR.—Worcester County; town of Gardner; about 2 miles
e city of Gardner; overflow passes northward to a pond on Pew
y through Foster Brook to Otter River and thus through Millers
nnecticut). Fitchburg sheet.

ROOK.—Plymouth County; head of Weweantic River (tributary
ay). *See* Weweantic River.

ROOK.—Worcester County; town of Shrewsbury; rises northwest of
South Shrewsbury; flows southwestward and southward into Lake
(outlet, Quinsigamond River to Blackstone River and thus through
Providence Rivers to Narragansett Bay); length, 2½ miles. Marl-

rkshire County; town of Florida; one-half mile southeast of North
Gulf Brook to Cold River (tributary through Deerfield River to the
Greylock sheet.

sex County; 2½ miles west of Methuen, about one-half mile south
husetts-New Hampshire boundary line, at altitude 160 feet above
let, a stream about one-half mile long flowing northeastward into a
tream (tributary through Spickett River to the Merrimack); length,
f mile; width, about one-fourth mile. Lawrence sheet.

Franklin County; towns of Ashfield and Conway; rises on the north
r Hill; flows southeastward 2 miles, passing through Great Pond,
circuitously eastward to its junction with Deerfield River (tributary
cticut); length, 14 miles. Hawley and Greenfield sheets.

Plymouth County; rises in the town of Duxbury near Little Creek
northwestward 4 miles, then northeastward 5 miles, and enters Massa-
at the mouth of North River. Duxbury sheet.

K.—Berkshire County; town of Adams; a stream 2 miles long flowing
into Hoosic River (tributary to the Hudson) near Renfrew. Grey-

K.—Middlesex County; rises in Sought For Pond, about 2 miles north-
ford station (Stony Brook Railroad); flows northwest one-fourth mile,
bout one-half mile, then southeast one-half mile into Keyes Pond;
gh Keyes Brook to Stony Brook and thus to the Merrimack. Lowell

Spectacle Pond.—Barnstable County; one of a group of ponds north of the villa Farmersville. Barnstable sheet.

Spectacle Pond.—Barnstable County; town of Falmouth; 1½ miles northwe East Falmouth. Falmouth sheet.

Spectacle Pond.—Berkshire County; 2 miles southwest of village of Otis; a about a mile long; elevation, 1,420 feet above sea level; principal inlet, a st about 3 miles long entering from the north; outlet through a stream one mile long to Clam River (tributary through Farmington River to the Conn cut). Sandisfield sheet.

Spectacle Pond.—Hampshire County; town of Wilbraham; west of North Wi ham and one-half mile south of Chicopee River (tributary to the Connecti about one-tenth mile from Nine Mile Pond. Palmer sheet.

Spectacle Pond.—Middlesex County, near North Littleton station; inlet, Be Brook; outlet, Bennett Brook to Forge Pond (tributary through Stony Bro the Merrimack); about 1 mile long. Groton sheet.

Spectacle Pond.—Plymouth County; town of Wareham; 1½ miles north of Onset; charges by a short stream flowing northward into Agawam River (tribu through Wareham River to Buzzards Bay); inlet, a stream from Cedar P Plymouth sheet.

Spectacle Pond.—Franklin County; town of New Salem; two ponds connected short northward-flowing stream and discharging from the northern pond stream flowing northward to Millers River and thus to the Connecticut); to the north pond, a stream about a mile long flowing north from Hacker P Warwick sheet.

Spectacle Pond.—Worcester County; a pond about one-fourth mile wide, which charges by a stream a mile long flowing southeastward and then southwest into North Branch of Nashua River (tributary through Nashua River to the rimack); inlet from Little Spectacle Pond. Groton sheet.

Spencer Brook.—Middlesex County; rises one-half mile west of Carlisle, at alti 180 feet above sea level, flows generally southward 5 miles into Assabet R (tributary through Concord River to the Merrimack); swampy through a part of its course. Lowell and Framingham sheets.

Spickett River.—Rockingham County, N. H., Essex County, Mass.; rises in the of Derry, Rockingham County, N. H., about 3 miles northeast of East De at altitude about 365 feet above sea level; flows southeastward 4 miles into Is Pond, then takes an irregular course southward 9½ miles, crosses into E County, Mass., and continues southeastward for 5 miles to Merrimack Rive Lawrence; principal tributaries in Massachusetts, streams from South and My ponds. Haverhill and Lawrence sheets.

Spoffords Pond.—Essex County; head of Pye Brook, 2 miles southeast of Boxford; altitude, about 120 feet above sea level; outlet, Pye Brook (tribu through Mile Brook to Ipswich River); small. Lawrence sheet.

Spooner Pond.—Plymouth County; town of Plymouth; 1 mile west of High discharges by a stream one-fourth mile long, flowing northward into Plym Bay. Plymouth sheet.

Spot Pond.—Middlesex County; about a mile west of Melrose; length, about a maximum width, about one-half mile; part of the reservoir system of the m politan water district of Boston and vicinity. Boston sheet.

Spring Brook.—Middlesex County; rises in Fawn Lake near Billerica Springs sta about 1½ miles north of Bedford, at altitude about 180 feet above sea level; f southeastward 1½ miles into Shawsheen River (tributary to the Merrimac mile east of Bedford; marshy near mouth; fall about 60 feet. Lowell and F ingham sheets.

outh County; town of Bridgewater; a stream 1½ miles long
rd into Taunton River (tributary to Narragansett Bay), about
of the mouth of Wenatuxet River; tributary, Beaver Brook.

ester County; town of Mendon; rises a mile south of the village
outhward one mile, and eastward 1½ miles into Muddy Brook
Mill River to Blackstone River and thus through Seekonk and
to Narragansett Bay). Blackstone sheet.

stable County; a tidal channel in the Great Marshes west of
; connects with Bridge Creek. Barnstable sheet.

–Barnstable County; town of Sandwich; a tidal channel in the
lwich; connects with Old Harbor Creek. Barnstable sheet.

County; about one-half mile north of Lynn; outlet, Tapley
to North River and thus to the Atlantic Ocean); altitude, about
level; length, about one-half mile; maximum width, about one-
ston Harbor sheet.

dlesex County; 2½ miles southeast of Groton, immediately south
tributary through Cow Pond and Cow Pond Brook to Salmon
to the Merrimack), with which it is connected by a very small
sheet.

shire County; western part of the town of Sheffield; outlet, a stream
ng southeastward into Willard Brook (tributary through Hubbard
b Brook and thus to the Housatonic). Sheffield sheet.

sex County; at Arlington and about a mile west of Somerville;
ne-half mile; maximum width, about one-fourth mile; natural
stream to Little Pond and thus through Little River to Alewife
y to Mystic River), formerly part of the reservoir system of Boston
Boston sheet.

tucket County; Nantucket Island; a narrow pond a mile northwest
of Quidnet; separated from the ocean by a narrow beach. Nan-

sex County; a tidewater channel about 3 miles long between Glou-
nd Annisquam Harbor; Little, Jones, and Mill rivers are tidewater
tary to Squam River, the two latter joining Squam River at its
ester sheet.

ER.—Middlesex County; rises in the northern part of the county in
hich receives the waters of Mason and Walker brooks draining the
of the town of Mason, N. H., and Locke and Willard brooks of the
y, Mass.; from Ash Swamp the Squannacook flows southeastward
s to its junction with Nashua River (tributary to the Merrimack)
ast of West Groton; fall from Ash Swamp to Nashua River, about 100
l tributaries below the swamp, Pearl Hill, Baberry Hill, Witch,
umpkin brooks, all from the west. Fitchburg and Groton sheets.

ND.—Dukes County; Marthas Vineyard; Gayhead; a large pond sepa-
e ocean by Squibnocket Beach on the west and a narrow-walled
east. The pond is about 1½ miles long (east-west) and more than a
mum width. Gayhead sheet.

—Essex County; rises in Glenmere Lake and flows generally south-
niles through the city of Lynn into Nahant Bay. Geologic map of
y, Mass.

.—Newport County, R. I.; outlet, Sucker Brook to North Watuppa
t through Quequechan River to Taunton River, and thus to Narra-
). A dam and flume at the outlet of the pond provide means for
k the flow for use in mills at Fall River. Report of the reservoir
to the city council of Fall River, Mass., July, 1902. Fall River

Steel Brook.—Franklin County; a stream about 2 miles long flowing east o
into Pelham Brook (tributary through Deerfield River to the Connecticu
half mile north of Zoar. Hawley sheet.

Steep Brook.—Bristol County; town of Fall River; a stream about 1½ mil
flowing westward into Taunton River (tributary to Narragansett Bay) a
Brook village. Fall River sheet.

Steep Gutter Brook.—Worcester County; rises near Williamsville, in th
of Hubbardston; flows southeastward 2½ miles, then northeastward o
mile into Burnshirt River (tributary through Ware River to Chicopee
and thus to the Connecticut). Barre sheet.

Stetson Pond.—Plymouth County; 1 mile north of the east end of Monponse
to which it discharges by a southward-flowing stream. Abington sheet.

Steven Brook.—Hampshire County; rises 1½ miles northwest of Worthingt
ners; flows southeastward 1½ miles, then northeastward one-half mile int
son Brook, the head of West Branch (tributary through Westfield River
Connecticut). Chesterfield sheet.

Steven Brook.—Worcester County; rises 1½ miles south of Barre Falls; flows
eastward one-half mile, then northeastward 1 mile into the swamp on War
(tributary through Chicopee River to the Connecticut) southeast of Barr
Barre sheet.

Stevens Brook.—Hampden County; town of Holland; rises in the extreme
eastern part of the town of Stafford, Conn.; flows northeastward about 2
then somewhat north of east 2 miles into Hamilton Reservoir (outlet t
Holland Pond to Mill Brook, and thus through Quinebaug River to She
River, Thames River, and Long Island Sound). Brookfield sheet.

Stevens Pond.—Essex County; a small pond at Lawrence; inlet, Spickett
outlet, Spickett River to the Merrimack. Lawrence sheet.

Stewards Pond.—Barnstable County; town of Barnstable; a mile north
west end of Great Pond. Barnstable sheet.

Stiles Pond.—Essex County; about 3 miles east of North Andover Center;
a stream about a mile long to Mosquito River (tributary to Ipswich River
tude, about 120 feet above sea level; length, about one-half mile; ma
width, about one-fourth mile. Lawrence sheet.

Stiles Reservoir.—Worcester County; town of Spencer; outlet, a stream a
mile long flowing southeastward into Greenville Reservoir on French
(tributary through Quinebaug River to Shetucket River, and thus t
Thames River to Long Island Sound). The reservoir is about 2 miles lo
more than half a mile wide. Webster sheet.

Still Brook—Hampden County; town of Agawam; rises in the northwester
of the township; flows southeastward 3½ miles, then passes into Connectic
joins Muddy Brook (tributary through Stony Brook to the Connecticut)
town of Suffield, Hartford County. Springfield and Hartford sheets.

Still River.—Worcester County; about a mile east of Lancaster, at altitude
240 feet above sea level; flows northeastward 2 miles, then northwestwar
fourth mile into Nashua River (tributary to the Merrimack). Marlboro sh

Stillwater River.—Worcester County; rises in a small lake at East Prince
altitude 750 feet above sea level; takes a general southeasterly course to W
sett Reservoir near Oakdale; principal tributaries, Keyes Brook, which
into the lake at its head, and Justice, East Wachusett, and Rocky brooks.

Stillwater River.—Worcester County; a stream about 2 miles long flowin
West Waushaccum Pond into Wachusett Reservoir. Worcester sheet.

Stirrup Brook.—Rises about 1 mile northwest of Westboro; flows irregularly
ward, passing through Chauncey, Little Chauncey, and Bartlett ponds, a
charges into Assabet River (tributary through Concord River to the Merr
about 2 miles northeast of Northboro; length, 5 miles. Marlboro sheet.

-Berkshire County; a large pond in the northern part of the
ge; northwest of Rattlesnake Hill; two inflowing streams, one
ered the head of Marsh Brook; outlet, Marsh Brook to Housa-
bowl is more than a mile long, and its maximum width is
s mile. Pittsfield sheet.

orcester County; 2 miles southwest of Winchendon Center;
ng streams; outlet, a stream 1½ miles long flowing westward
(tributary through Millers River to the Connecticut). Win-

ND.—Worcester County; north slope of Mount Hunger, at alti-
feet above sea level; inlet, Whitemans Brook; outlet, Souhegan
to Merrimack River); about three-fourths mile long; area, 127
g sheet.

rcester County; town of Millbury; rises on the southwest slope
flows northeastward into Ramshorn Brook (tributary through
Blackstone River, and thus through Seekonk and Providence
ansett Bay) near Pondville; length, about 2 miles. Webster

ranklin and Hampshire counties; rises in the town of Ashfield;
west of south 4 miles, then almost west 1 mile to its junction with
ibutary through Westfield River to the Connecticut). Hawley
l sheets.

VOIR.—Worcester County; town of Auburn; 1 mile southwest
inlet, Dark Brook; outlet, Dark Brook to Kettle Brook (tributary
River, and thus through Seekonk and Providence rivers to Narra-
Webster sheet.

ampshire County; rises on Bagg Hill, in the town of Granby;
stward 3½ miles, thence in general northwestward to its junction
cut River, 1½ miles west of South Hadley; length, about 10 miles;
lled Muddy Brook for a short stretch of its middle course. Palmer,
nd Northampton sheets.

Middlesex County; rises about 1 mile southwest of Boxboro, at
t 330 feet above sea level; flows northeastward to its junction with
iver at North Chelmsford; passes through Mill and Forge ponds.
Pond it is called Beaver Brook; length from head of Beaver Brook
d, 9 miles; from outlet of Forge Pond to Merrimack River, 8 miles;
utaries below Forge Pond are Keyes Brook and Gilson Brook. The
ns a number of ponds, of which Newfield, Nabnasset, Flushing,
Keyes, Forge, Mill, and Spectacle are the largest. Marlboro, Groton,
heets.

-Middlesex County; rises in Sandy Pond, one-half mile northwest of
altitude about 230 feet above sea level; flows in a general south-
rse into Charles River in the town of Weston; length, about 7 miles;
ibutaries, Cherry and Hobbs Brooks. Framingham sheet.

–Plymouth County; a stream about a mile long, flowing southeastward
ng North River 1½ miles below Second Herring Brook. Abington

—Plymouth County; town of Carver; head of Wenatuxet River (tribu-
gh Taunton River to Narragansett Bay); a westward flowing stream
iles long, joining Wenatuxet River near the village of North Carver.
o sheet.

.—Plymouth County; town of Middleboro; a stream about a mile long
thward into Furnace Pond on Fall Brook (tributary through Namasket
aunton River and thuse to Narragansett Bay). Middleboro sheet.

Stony Brook.—Suffolk County; rises near East Dedham, in the Stony Brook Rese
tion; flows in general east of north to Jamaica Plain, where it is taken into
sewers. Boston sheet.

Stop River.—Norfolk County; rises about 1½ miles northwest of Wrentham, at alti
220 feet above sea level; flows northeastward to a point about a mile sout
Highland, then irregularly northward to its junction with Charles River; len
about 10 miles; passes through Reservoir Marsh Pond. Franklin sheet.

Stream River.—Plymouth County; towns of Abington and Whitman; rises 1½ r
northwest of Whitman; flows northwestward nearly a mile, northeastward
half mile, then southeastward 2 miles into Shumatuscacant River (head of
tucket River, which is tributary through Matfield River to Taunton River
thus to Narragansett Bay). Abington sheet.

Strongs Pond.—Suffolk and Middlesex Counties; one-half mile northwest of Ches
Hill Reservoir; one inlet; outlet eastward to Chandler Pond, which is draine
a stream flowing northward into Charles River. Boston sheet.

Strongwater Brook.—Middlesex County; rises just northeast of North Tewksb
about 2½ miles east of Lowell, at altitude 180 feet above sea level; flows so
eastward about 2 miles, southward 1½ miles, and again southeastward 1 mile
Shawsheen River (tributary to the Merrimack) about 2 miles southeast of Te
bury Center. Lawrence sheet.

Stump Pond.—Plymouth County; town of Halifax; a long narrow pond in the so
ern part of Great Cedar Swamp; connected with a narrow channel by Monpo
Pond; outlet, a stream a mile long flowing north of west to Robbin Pond, w
discharges to Satucket River (tributary through Matfield River to Taunton R
and thus to Narragansett Bay). Abington and Middleboro sheets.

Sucker Brook.—Bristol County, Mass., and Newport County, R. I.; rises in Sta
Pond in Newport County, R. I.; flows west of north 1 mile and northeastw
1½ miles into South Watuppa Pond; outlet through Quequechan River to Tau
River and thus to Narragansett Bay. Fall River sheet. *See also* Report of
Reservoir Commission to the city council of Fall River, Mass., July, 1902.

Sucker Brook.—Worcester County; rises on the southeast slope of Fort Hill; f
soutwestward 2 miles, then southeastward 1 mile into Lake Chaubunagungan
outlet, Mill Brook to French River (tributary through Quinebaug River to
tucket River and thus through Thames River to Long Island Sound). Web
sheet.

Sucker Brook.—Worcester County; town of New Braintree; the head of Mill B
(tributary through Wickaboag Pond to Quaboag River and thus through Chic
River to the Connecticut); length of the stretch called Sucker Brook, abo
miles. Barre sheet.

Sucker Brook.—Worcester County; town of West Brookfield; rises on the north s
of Wigwam Hill; flows southwestward 2 miles into Mill Brook just above
point at which that stream discharges into Wickaboag Pond (outlet Qua
River to Chicopee River and thus to the Connecticut). Barre sheet.

Sucker Pond.—Middlesex County; a small pond a mile north of South Framing
and one-half mile east of Sudbury River; outlet, a stream three-fourths mile
flowing southwestward into Sudbury River (tributary through Concord Rive
the Merrimack); altitude, about 170 feet above sea level; Framingham sheet

Sudbury Pond.—Middlesex County; in the town of Saxonville; inlet, Sudb
River to Concord River and thus to the Merrimack); altitude, about 150
above sea level. Framingham sheet.

Sudbury River.—Middlesex County; a small stream of eastern Massachus
formerly received water from an area west of Framingham but is now fed ch
by streams that enter it north and east of Framingham. Drainage area now

›ws thence in a northerly course through meadows and swamps
River to form Concord River, which in turn continues north-
rrimack River immediately below the city of Lowell. Storage
en constructed by the city of Boston and the Metropolitan
;e Board, controlling the greater part of the flow from this basin.

› lies in the Sudbury basin a short distance below Framing-
olled as a storage reservoir by the Metropolitan Water Works.
-298 of this report.

-Franklin County; rises on the west slope of North Sugarloaf;
d three-fourths mile, then southeastward 2 miles into Connec-
thampton sheet.

pshire County; town of Enfield; rises about 2 miles east of the
lows northwestward 2 miles through Sunk Pond into Swift River
;h Ware River to Chicopee River and thus to the Connecticut).
et.

ristol County; town of Dighton; rises 1 mile west of North Digh-
ıeastward into Segreganset River (tributary through Taunton
ansett Bay); 2½ miles long. Taunton sheet.

pshire County; town of Enfield; south of Mount Lizzie on Sunk
y through Swift River to Ware River and thus through Chicopee
›nnecticut); very small. Belchertown sheet.

:ester County; town of Dana; 1½ miles northwest of Pottapaug
stream about 2 miles long flowing northwestward into the Middle
1 of Swift River (tributary through Ware River to Chicopee River
› Connecticut). Belchertown sheet.

·Middlesex County; 2½ miles east of Wakefield; no inlet shown on
.et, a stream 3½ miles long flowing northward into Ipswich River;
t 80 feet above sea level; length, one-half mile; maximum width,
f mile. Lawrence sheet.

·Plymouth County; town of Pembroke; rises north of the village of
.d flows northward about 2 miles into Herring Brook (tributary to
. Abington sheet.

Middlesex County; a small pond near the head of Pines River just
len; inlet, Pines River; outlet, Pines River to Saugus River and thus
›ay; altitude, about 100 feet above sea level; very small. Boston

Barnstable County; town of Dennis; 1 mile north of Dennis Port;
n River to Nantucket Sound; three-fourths mile long; one-half mile
mouth sheet.

Barnstable County; town of Yarmouth; outlet, a stream one-fourth mile
g southwestward into Parkers River (tributary to Nantucket Sound).
sheet.

-Essex and Middlesex Counties; 1½ miles northeast of North Reading;
stream 4 miles long flowing generally eastward into Ipswich River;
ıbout 80 feet above sea level; small. Lawrence and Salem sheets.

RIVER.—Barnstable County; town of Dennis; rises in Swan Pond 1
hwest of Dennis Port; flows southwestward 2½ miles into Nantucket
armouth sheet.

K.—Berkshire County; town of Williamstown; rises a mile southeast of
ountain; flows southeastward 1 mile, then northeastward 1½ miles into
Brook (tributary through Hoosic River to the Hudson). Berlin and
sheets.

Swift River, East Branch.—Worcester and Hampshire counties; formed in the of Petersham by the union of Shattuck and Bigelow brooks. Shattuck B considered the head of the East Branch of the Swift, rises just south of Philli and flows southwesterly. Below its junction with Bigelow Brook the st continues its southwesterly course to the town of Greenwich in Hampshire Co where it joins the Middle Branch or head of Swift River (tributary through River to Chicopee River and thus to the Connecticut); length to the head of tuck Brook, 20 miles; principal tributaries, Moccasin, Rutland, and Silver br passes through Pottapaug and East ponds. Winchendon, Barre, and Bel town sheets.

Swift River.—Franklin and Hampshire counties; rises near the village of Ha flows southerly 9 miles to its junction with Westfield River (tributary to the necticut) at Swift River village in the town of Goshen; principal tribu Stones Brook and North Branch of Swift River. Hawley and Chesterfield sh

Swift River.—Franklin, Worcester, Hampshire, and Hampden counties; form the town of Greenwich by the union of its East and Middle branches. Middle Branch, considered the continuation of the main stream, rises in Pond in the town of Orange, and flows southward to the point at which it rec the East Branch. Below that point the general course of the Swift is some west of south to Four Corners, where it joins Ware River (tributary thr Chicopee River to the Connecticut); length from North Pond to junction wit Ware, about 30 miles; principal tributary below the mouth of the East Br is the West Branch, which enters 1½ miles below Enfield; total drainage above junction with Ware River, 213 square miles. The basin of the M Branch contains several large ponds, including, besides North Pond, Spect Hacker, Thompson, and Neseponset ponds. Gaging station at West 1910–1915. Warwick, Winchendon, Belchertown, Barre, and Palmer sheets. *also* pages 124–134 of this report.

Swift River, Middle Branch.—Head of Swift River. *See* Swift River.

Swift River, North Branch.—Hampshire and Franklin counties; rises on W Hill in the town of Plainfield; flows southeasterly 7 miles into Swift River (t tary through Westfield River to the Connecticut) at the village of Swift R Hawley and Chesterfield sheets.

Swift River, West Branch.—Hampshire and Franklin counties; rises in the to Wendell in Franklin County; flows east of south 18 miles to Enfield in Hamp County, where it enters Swift River (tributary through Ware River to Chic River and thus to the Connecticut); principal tributaries, Purgee Brook and well Creek; the basin is narrow and mountainous and the tributaries are s The map shows only two small ponds in the area. Warwick and Belcher sheets.

Swifts Pond.—Plymouth County; town of Wareham; a mile north of Onset; charges by a stream flowing southward into Onset Bay and thus to Buzzards Plymouth sheet.

Sykes Brook.—Berkshire County; a stream about a mile long flowing westward Housatonic River in the southeastern part of the town of Pittsfield. Be sheet.

Tamett Brook.—Plymouth County; town of Lakeville; a stream about a mile flowing northeastward into Assawompsett Pond (outlet Namasket River to T ton River and thus to Narragansett Bay). Middleboro sheet.

Tanner Brook.—Berkshire County; town of Savoy; rises on the east slope o Hoosac Range; flows northeastward 2½ miles, then easterly 1½ miles to its jun with Cold River (tributary through Deerfield River to the Connecticut). C lock and Hawley sheets.

County; rises in Spring Pond, at altitude about 80 feet above
thward 1½ miles through a small pond into Goldthwait Brook
River and thus to the Atlantic Ocean at Beverly Harbor).
Salem sheets.

pden County; town of Agawam; a stream 1½ miles long, flowing
Threemile Brook (tributary to Connecticut River). Spring-

rcester County; rises north of Stone House Hill; flows westward
nce southeastward through a series of artificial reservoirs to
e head of Blackstone River (tributary through Seekonk River
er and thus to Narragansett Bay); length, 7 miles. Worcester
ts.

orfolk, Plymouth, and Bristol counties; formed in the eastern
f Bridgewater by the union of Matfield and Town rivers. Mat-
h drains the larger area and is considered the continuation of
rises in the swamp northeast of Stoughton and takes a general
rse to the junction with Town River; below this point the general
r is southeasterly and southerly to the head of Narragansett Bay,
scharges; length of stream from head of Matfield River (called
River in its upper course) to Narragansett Bay, including major
50 miles; principal tributaries below mouth of Town River,
nasket, Mill, and Threemile rivers. The Taunton is tidal up to
here there is about 2½ feet of rise and fall, and it is navigable to the
about a mile south of Taunton. The basin contains a large number
and swamps, and the run-off through the year is fairly uniform.
nfall in the region is about 46 inches. Gaging stations have been
Matfield River at Elmwood, 1909–10, and on Satucket River, a
eld River, near Elmwood, 1909–10.
U. S. Geol. Survey Water-Supply Paper 281, pp. 145–146, 1912;
ham, Franklin, Providence, Taunton, Middleboro, New Bedford,
sheets.

Hampden and Worcester counties; rises on the north slope of Steer-
s northeastward 2 miles into Tufts Brook, the head of Blodgett Mill
ry through Quaboag River to Chicopee River and thus to the Con-
ookfield sheet.

-Barnstable County; east of South Chatham; outlet southward
sh to Nantucket Sound. Yarmouth sheet.

—Bristol County; rises 1 mile northeast of North Attleboro; flows
l to Attleboro, southwestward to East Providence, R. I., then
d through Seekonk River to Providence River and thus to Narra-
length, 16 miles; principal tributaries, Bungay River, Thatcher
evenmile River. Below Hebronville the course of the river is just
hode Island boundary. Providence sheet.

Franklin County; town of Buckland; a stream a mile long, flowing
d into Deerfield River (tributary to the Connecticut) a mile east of
Second Brook. Hawley sheet.

Brook.—Plymouth County; rises in the swamp north of West Scitu-
wn of Norwell; flows southeastward 6 miles into North River; principal
Silver and White Cat brooks. Abington sheet.

ok.—Berkshire County; town of New Ashford; a stream 1⅓ miles
g southeastward into Green River (tributary through Hoosic River to
) 2 miles north of the village of New Ashford. Greylock sheet.

Thompson Pond.—Franklin County; town of New Salem; inlets, two small str from the north; outlet, Middle Branch of Swift River (tributary through S River through Ware River and thus through Chicopee River to the Connecti Belchertown sheet.

Thompsons Brook.—Bristol County; town of Taunton; rises one-half mile nor Elders Pond; flows northwestward and northward into Taunton River (tribu to Narragansett Bay), 2 miles east of East Taunton; passes through a numb small ponds; length, about 4 miles. Middleboro and Taunton sheets.

Three Cornered Pond.—Plymouth County; town of Plymouth; one of a grou small ponds in the west-central part of the township. Plymouth sheet.

Threemile Brook.—Hampden County; town of Agawam; rises 2 miles northwe Agawam Village; flows southeasterly 3 miles into Connecticut River; prin tributaries, Tarkill and Worthington Brooks. Springfield sheet.

Threemile Pond.—Berkshire County; northeastern part of the town of Sheffiel Ironworks Brook (tributary to the Housatonic). Sheffield sheet.

Threemile River.—Norfolk and Bristol Counties; formed in the town of Norto the junction of Rumford and Wading Rivers. Wading River, which drain larger area and is therefore considered the continuation of Threemile River, in the town of Foxboro and takes a general southeasterly course to its junc with Rumford River; below this junction Threemile River flows southeast through North Dighton, where it enters Taunton River (tributary to Narragan Bay); length to head of Wading River, about 25 miles. Franklin, Dedh Providence, and Taunton sheets.

Thunder Brook.—Berkshire County; town of Cheshire; rises 1 mile south Rounds Rock; flows southeasterly 1 mile, southerly one-half mile, and eas one-half mile into Kitchen Brook (tributary through Hoosic River to the Hud Berkshire County.

Tiasquam River.—Dukes County; Marthas Vineyard; rises near the villag Chilmark; flows northeastward to West Tisbury, then southeastward into Tisb Great Pond through its northern arm. The only stream on the island name the maps. Gayhead and Marthas Vineyard sheets.

Tihonet Pond.—Plymouth County; town of Wareham; inlets, Frog Foot Brook Wankinco River; outlet, Wankinco River to Wareham River (tributary Buzzards Bay). Plymouth sheet.

Tillison Brook.—Hampden County; rises 1½ miles north of East Granville; f eastward 2 miles, then southeastward one-half mile to the north base of So Mountain, where it joins Dickinson Brook to form Munn Brook (tributary thr Westfield Little River to Westfield River and thus to the Connecticut). G ville sheet.

Tillson Brook.—Plymouth County; town of Carver; rises 1½ miles northeast o village of Carver; flows southward 3½ miles into Sampson Pond (tributary thr Sampson Brook to Weweantic River and thus to Buzzards Bay). Plymouth sh

Tisbury Great Pond.—Dukes County; Marthas Vineyard; one of the series of nected ponds on the south shore of the island separated from the ocean by a tinuous barrier beach. Tiasquam River enters this pond through its nort arm, which receives also a stream flowing through North Tisbury. The no eastern shore of this pond is characterized by long narrow arms called coves. width of the pond parallel to the ocean is about a mile. Its greatest le (northwest-southeast) is about 2 miles. Marthas Vineyard sheet.

Tispaquin Pond.—Plymouth County; town of Middleboro; principal inlet, Sh Brook (Fall Brook); outlet, Fall Brook to Namasket River (tributary thr Taunton River to Narragansett Bay). Middleboro sheet.

Tom Nevers Pond.—Nantucket County; Nantucket Island; back of Tom Ne Head; 1½ miles southwest of Siasconset. Nantucket sheet.

kshire County; rises 3 miles northeast of Adams; flows south-
then northwesterly 2½ miles to Adams, where it joins Hoosic
o the Hudson); tributaries, Reed Brook and Anthony Creek.

nouth County; town of Norwell; on Second Herring Brook
h River). Abington sheet.

kshire County; rises on the east slope of the Hoosac Range,
½ miles, then easterly 2 miles into Cold River (tributary through
o the Connecticut); many small branches, one of which drains
of the few ponds in the basin of the Deerfield in Massachusetts.

nklin County; a stream about 1½ miles long, flowing southeast-
eld River (tributary to the Connecticut) about a mile above
Hawley sheet.

mouth County; town of Plymouth; rises in Little Pond, flows
nto Billington Sea, then northeastward into Plymouth Harbor, a
husetts Bay; length below Billington Sea, about 2 miles. Plym-

OOK.—Worcester County; town of Leicester. *See* French River.

folk County; rises on the eastern slope of the Blue Hill Range, in
incy; flows eastward 2 miles, then northward and northeastward
ain eastward a mile or more to its junction with Weymouth Fore
hannel in its lower course. Dedham and Boston Bay sheets.

rfolk, Bristol, and Plymouth counties; rises in the town of
s southeastward into a swamp of about 7,000 acres, known as the
amp, and from this natural reservoir passes northeastward thourgh
ter, then southeastward to its junction with Matfield River (tribu-
aunton River to Narragansett Bay) at Paper Mill village; length,
; called Hockomock River, as it enters the swamp and Cowesett
etch east of Eastondale; principal tributaries, below the swamp,
Brook and South Brook. Dedham, Taunton, and Middleboro

K.—Middlesex County; rises in the extreme northwestern part of
shby, at altitude 1,040 feet above sea level; flows southeastward 4
llard Brook (tributary through Ash Swamp to Squannacook River
ugh Nashua River to the Merrimack. Fitchburg sheet.

K.—Norfolk County; rises 1 mile north of Moose Hill in the western
wn of Sharon; takes a very circuitous but in general northeasterly
ischarges into Neponset River near the upper end of the Great
gth, including major windings, about 4 miles. Dedham sheet.

Dukes County; Marthas Vineyard; northwest of Edgartown; con-
Sengekontacket Pond. Marthas Vineyard sheet.

AND CREEK.—Essex County; a tidal creek 1½ miles east of Ipswich,
Creek and emptying into Ipswich River, opposite Little Neck.

.—Barnstable County; one of a group of ponds north of the village of
. Barnstable sheet.

.—Plymouth County; town of Plymouth; one-fourth mile northeast
th Pond. Plymouth sheet.

.—Plymouth County; town of Plymouth; 2 miles west of the city of
Plymouth sheet.

OND.—Plymouth County; town of Hingham; a small pond on Weir
ington sheet.

Triple Brook.—Hampshire County; town of Southampton; a stream about 2 long, flowing northwestward into Manhan River (tributary to the Connec in the southern part of the town of Southampton. Springfield sheet.

Trout Brook.—Berkshire and Hampshire counties; head of Middle Branch of field River (tributary through Westfield River to the Connecticut). Beck Chesterfield sheet.

Trout Brook.—Middlesex County; a stream about 2 miles long rising 2 miles so Townsend Harbor and flowing north and northeast into Squannacook (tributary through Nashua River to the Merrimack). Groton sheet.

Trout Brook.—Middlesex County; rises one-half mile southeast of Burns Hil 3 miles northeast of Centralville, at altitude 140 feet above sea level; flows ally southward 2½ miles into Merrimack River; principal tributary, Rich Brook. Lowell sheet.

Trout Brook.—Norfolk County; rises about 1 mile west of Snow Hill at al 180 feet above sea level; flows northward 3 miles into Charles River; swam lower half of course. Franklin and Framingham sheets.

Trout Brook.—Worcester County; rises on the east slope of Barrett Hill, at al 860 feet above sea level; flows southeastward about 2½ miles into Quins River (tributary to Wachusett Reservoir); principal tributary, Governor Worcester sheet.

Trout Brook.—Worcester County; town of Templeton; rises on the south sl Church Hill; flows southeastward 2 miles, then northward 4 miles into River (tributary through Millers River to the Connecticut); principal trib Crow Hill Brook. Near Brooks village it passes through several ponds. chendon sheet.

Trull Brook.—Middlesex County; about 2 miles southeast of Lowell; at al 160 feet above sea level; flows northward 2½ miles into Merrimack River. sheet.

Tubbs Meadow Brook.—*See* Jones River.

Tufts Branch.—Worcester County; town of Dudley; rises about 1½ miles sout of the village of Tufts; flows irregularly southward about 4 miles to its ju with Quinebaug River (tributary through Shetucket River to Thames Riv thus to Long Island Sound) near the village of New Boston, Windham C Conn. Webster sheet.

Tufts Brook.—Worcester County; town of Warren; the head of Blodgett Mill (tributary through Quaboag River to Chicopee River and thus to the Connec Brookfield sheet.

Tully Brook.—Franklin County; the head of the West Branch of Tully River Tully River, West Branch. Warwick sheet.

Tully River, East Branch.—*See* Tully River.

Tully River, West Branch.—Franklin County; rises just south of the New shire-Massachusetts boundary line; flows southeastward 9 miles to its ju with Tully River (tributary through Millers River to the Connecticut at Pin north of Athol). Called Tully Brook above the pond northwest of Tully Warwick and Winchendon sheets.

Tully River.—Worcester and Franklin counties, Mass., Cheshire County, formed north of Athol by the union of its East and West branches. The Branch, which drains the larger area and is therefore considered the contin of the main stream, is formed in the northwestern part of the town of Royals the union of Fall and Hunting (or Tilly) brooks. Tilly Brook, which thus the head of Tully River, rises west of Little Monadnock Mountain, in the to Richmond. N. H., and flows west of south to its junction with Fall Brook. this point the East Branch of Tully River flows southeastward to Long

ı and southwestward to Pinedale, where it receives the West
.he mouth of the West Branch its course is southward to Millers
to the Connecticut) at Athol; length to head of Tilly Brook,
›rincipal tributaries, Boyce and Lawrence brooks, and the West
nock, Keene, Winchendon, and Warwick sheets.

ˉnstable County; town of Sandwich; a tidal channel in the marsh
Beach. Plymouth sheet.

K.—Worcester County; rises 2 miles northwest of Turkey Hill,
ʼard through Turkey Hill Pond, thence southwesterly to the
, where it unites with Sevenmile River (tributary through East
:r to Quaboag Pond and thus through Quaboag River through
· and the Connecticut); length, 8 miles; principal tributary,
Worcester sheet.

.—Worcester County; at west base of Turkey Hill; outlet, Turkey
Sevenmile River (tributary through East Brookfield River to
and thus through Chicopee River to the Connecticut). Worcester

Vorcester County; 2 miles southwest of Shirley village; outlet
Brook to stream flowing from Shirley Reservoir to Nashua River
he Merrimack). Groton sheet.

arnstable County; town of Yarmouth; a small marshy pond dis-
Bass River (tributary to Nantucket Sound); northeast of South
ʼarmouth sheet.

Iampshire County; town of Prescott; a small pond which lies less
th mile east of the Middle Branch of Swift River, but discharges
which is tributary through Ware River to Chicopee River and thus
:ticut) by a stream that flows southwestward more than 3 miles and
h Warner and Curtis ponds. Belchertown sheet.

—Plymouth County; rises in the southern part of the town of Dux-
outhward into Hall Brook (tributary through Jones River to Kingston
h of Massachusetts Bay); length, about a mile. Duxbury sheet.

–Hampshire County; rises in the southeastern part of the town of
kshire County; flows southeastward 5 miles into Middle Branch of
:ver (tributary through Westfield River to the Connecticut). Becket
field sheets.

ɩOOK.—Hampden County; rises in the town of Monson, on the north
ɔn Mountain; flows northerly 3 miles, then northwesterly 3 miles into
iver (tributary to the Connecticut) near Butlerville. Palmer sheet.

Middlesex County; 2½ miles northwest of Lowell; about three-fourths
ınd one-half mile in maximum width; outlet, a steam about 1 mile
ɩg northwestward into Lawrence Brook (tributary to the Merrimack).
et.

-Norfolk County; about 1½ miles southeast of Franklin; inlet, a stream
g flowing northward and then south of east into Whiting Pond (tributary
River). Franklin sheet.

ɩTON POND.—Worcester County; 2½ miles northwest of Shirley Reser-
ude, about 510 feet above sea level; two outlets, one a stream flowing
ıbout 1 mile into Catacoonamug Brook (tributary through Shirley Reser-
shua River, and thus to the Merrimack), the other a stream about 4 miles
ng from the south end, encircling the base of Nichols Hill, and passing
Iassapoag Pond to its junction with Catacoonamug Brook; about one-half
:; maximum width, one-half mile. Groton sheet.

Unkamet Brook.—Berkshire County; rises on Oak Hill in the town of Pitts flows southerly and southeasterly into Housatonic River; 2½ miles long. B sheet.

Unkety Brook.—Middlesex County; rises 1 mile west of East Groton Station; west of north 4½ miles into Nashua River (tributary to the Merrimack); sw throughout most of its course. Groton sheet.

Unquomonk Brook.—Hampshire County; town of Williamsburg; rises on the slope of Petticoat Hill; flows southeastward 2 miles, northeastward 1 mile eastward one-half mile into Mill River (tributary to the Connecticut) ab mile southeast of the city of Williamsburg. Used by Williamsburg as a sou municipal supply. Chesterfield and Northampton sheets.

Upper Gate Pond.—Barnstable County; 1½ miles north of Hyannis, immedi west of Halfway Pond; very small. Barnstable sheet.

Upper Goose Pond. *See* Goose Pond, Upper.

Upper Pond.—Hampshire County; near the east end of the Holyoke Range; o Bachelor Brook, which flows through Middle and Lower ponds, and Forge and into Connecticut River. Belchertown sheet.

Upper Reservoir.—Worcester County; town of Paxton; on west slope of Asnebumskit Hill; natural outlet, Kettle Brook to Blackstone River, and through Seekonk and Providence rivers to Narragansett Bay; used as a p the water supply system of Worcester. Worcester sheet.

Valley Brook.—Hampden County; rises in the northern part of the town of ville; flows somewhat west of south 6 miles and unites with the East Bran Farmington River (tributary through Farmington River to the Connectic the northern part of the town of Hartland in Hartford County, Conn.; l above Massachusetts State line, 5 miles. Granville sheet.

Varnum Brook.—Middlesex County; a stream about 1½ miles long flowing s eastward into Nashua River (tributary to the Merrimack) at East Pepp Groton sheet.

Venturers Pond.—Hampshire County; a small pond 3 miles east of Spring about halfway between the North and South branches of Mill River (trib to the Connecticut). Springfield sheet.

Vine Brook.—Middlesex County; rises in a small pond southwest of Loring H mile southwest of Lexington, at altitude about 240 feet above sea level; northeast 2 miles through the town of Lexington, northward 2 miles pa through several ponds, then northwestward 2 miles into Shawsheen River (t tary to the Merrimack) 1½ miles northeast of Bedford; marshy through mu its course. Boston, Lowell, and Lawrence sheets.

Waban Pond.—Norfolk County; 1½ miles east of Natick; inlet, a stream from M Pond; outlet, a stream one-half mile long flowing southward from the east of the lake into Charles River. Framingham sheet.

Wachusett Brook, East.—Worcester County; rises on the south slope of Wach Mountain, at altitude about 1,320 feet above sea level; flows southeastward junction with Stillwater River (tributary to Wachusett Reservoir), near Sterling; length, about 5 miles; principal tributary, Babcock Brook. Worc sheet.

Wachusett Brook, South.—Rises in Worcester County in the town of Princeto the southwest slope of Wachusett Mountain, at altitude about 1,100 feet a sea level; flows southwestward 2 miles, then southeastward 4 miles into Q poxet Pond; outlet, Quinapoxet River (tributary to Wachusett Reservoir). cester sheet.

Wachusett Pond.—Worcester County; town of Princeton; north slope of Wach Mountain; several small inflowing streams; outlet to Grass Pond, which disch through Whitman River into North Branch of Nashua River (tributary thr Nashua River to the Merrimack); altitude, 870 feet above sea level; length, a three-fourths mile; maximum width, three-eighths mile. Fitchburg sheet.

IR.—Worcester County; on South Branch of Nashua River be-
d Oakdale; watershed tributary to reservoir, 108.84 square miles,
rface in reservoir at high water, 6.48 square miles; capacity;
llons at high water; elevation, 395 feet; water stored since 1903;
water supply system of Boston and vicinity. Maps of metro-
trict. *See also* page 283 of this report.

orfolk and Bristol counties; head of Threemile River. *See*
r.

e Mashpee Pond.

ddlesex County; about 1 mile south of Concord and just east of
1½ miles east of Sudbury River (tributary through Concord River
k); altitude, about 160 feet above sea level; about one-half mile
rth mile wide. Framingham sheet.

sex County; a reservoir constructed for the water supply of Lynn;
nile east of North Saugus on the south slope of Mount Paran; inlet,
outlet, Penny Brook to Hawkes Brook, and thus to Saugus River,
es into Boston Bay; length, 1 mile; maximum width, one-half mile;
den Pond is called Glen Lewis Pond and lies on the south slope of
n and Mount Spicket; length of Glen Lewis Pond, about one-half
Map in report of Massachusetts State Board of Health.

ampden County; town of Wales; rises about a mile southeast of
lows northwestward through the pond to the village of Wales,
stward and northward about 5 miles to its junction with Mill Brook
ugh Quinebaug River to Shetucket River and thus through Thames
Island Sound). Brookfield sheet.

mpden County; town of Wales; south of the village of Wales; outlet,
to Mill Brook (tributary through Quinebaug River to Shetucket
s through Thames River to Long Island Sound). Brookfield sheet.

—Berkshire and Hampden counties; rises in the town of Becket 1½
Becket Center; flows southeastward 3 miles, then in general north-
iles to Chester, where it enters West Branch of Westfield River
rough Westfield River to the Connecticut). Becket, Sandisfield,
eld sheets.

—Hillsboro County, N. H., Middlesex County, Mass.; rises in the
part of the town of Mason in Hillsboro County, N. H., at altitude
t above sea level; flows southeastward about 5 miles into Ash Swamp
ined through Squannacook River to Nashua River and thus to the
Fitchburg sheet.

-Worcester County; three-fourths mile southeast of Walker Mountain;
s Brook to Quinebaug River (tributary through Shetucket River to
er and thus to Long Island Sound). Brookfield sheet.

.—Barnstable County; town of Harwich; 2 miles north of South
Yarmouth sheet.

lymouth County; town of Plymouth; three-fourths mile northeast of
d Pond. Plymouth sheet.

—Worcester County, Mass., and Providence County, R. I.; outlet,
er to Blackstone River (tributary to Seekonk River and thus through
River to Narragansett Bay); about 2 miles long and one-fourth mile
bster sheet.

ER.—Plymouth County; rises in East Head Pond; flows west of south
honet Pond and the pond south of the village of Tihonet into Wareham
utary to Buzzards Bay) at Wareham Center. East Head Pond is on
ry between the towns of Carver and Plymouth and the river forms part
ndary north of the Wareham line. Plymouth sheet.

Wanpenum Brook.—Berkshire County; rises on the west slope of South Mount south of Pittsfield; flows northwestward 1 mile, southeasterly 1½ miles to Melv Lake, then northeastward one-half mile to Housatonic River. Pittsfield Becket sheets.

Ward Pond.—Berkshire County; 1½ miles northeast of North Otis; on the h of Farmington River (tributary to the Connecticut). Sandisfield sheet.

Ward Pond.—Worcester County; 1 mile southeast of Watatic Mountain, on Souhe River (tributary to Merrimack River); altitude about 1,090 feet above sea le area, 56 acres. Fitchburg sheet.

Wards Stream.—Hampshire County; town of Worthington; head of Little Ri (tributary to the Connecticut). Chesterfield sheet.

Wareham River.—Plymouth County; a tidal channel extending from Buzzards northward into the town of Wareham; principal tributaries, Wankinco River Agawam River. Plymouth and Falmouth sheets.

Ware River.—Head of Chicopee River. *See* Chicopee River.

Warner Pond.—Hampshire County; town of Prescott; inlet from Turtle Pond; ou through Curtis Pond to the Middle Branch or head of Swift River (tribut through Ware River to the Chicopee and thus to the Connecticut). Belchert sheet.

Warren Brook.—Worcester County; rises 3 miles north of Upton; flows west of so 4 miles into West River (tributary to Blackstone River and thus through Seek and Providence rivers to Narragansett Bay) at West Upton. Blackstone shee

Warren Reservoir.—Bristol County; town of Swansea; 2 miles west of Swa Factory; outlet, Kickamuit River to Mount Hope Bay and thus to Narragan Bay. Taunton sheet.

Warren River.—Bristol County, Mass., and Bristol County, R. I.; rises sout North Rehoboth; flows very irregularly southwestward into Narragansett east of Rumstick Neck; called Palmer River above Harris; length to hea Palmer River, about 18 miles; tidal in its lower course; principal tributa Bad Luck, Bliss, Carpenters, and Clear Run brooks, and Rocky Run. Taun Providence, and Narragansett Bay sheets.

Wash Brook.—Middlesex County; formed by the junction of Hop and Landl brooks on the south slope of Green Hill, 2 miles north of Saxonville, at altit about 120 feet above sea level; flows generally eastward 2 miles through a swa area into Sudbury River (tributary through Concord River to the Merrima Framingham sheet.

Washing Pond.—Nantucket County; Nantucket Island; north of Maxey Pond one-fourth mile south of Nantucket Sound; small. Nantucket sheet.

Washington Mountain Brook.—Berkshire County; rises a mile northwest of Be Mountain; flows northwestward 3 miles, then southwestward 2½ miles to its ju tion with Housatonic River about 1½ miles north of Lee. Becket sheet.

Watatic Pond.—Worcester County; 1 mile southeast of Watatic Mountain and fourth mile northeast of Ward Pond with which it is connected by Souhe River; area, 28 acres; outlet, Souhegan River to Merrimack River. Fitch sheet.

Watcha Pond.—Dukes County; Marthas Vineyard; one of a series of ponds on south shore of the island, separated from the ocean by a continuous barrier be about halfway between Tisbury Great Pond and Edgartown Great Pond. Mar Vineyard sheet.

Waters River.—Essex County; a tidal estuary 1½ miles northwest of Salem; le 1½ miles to Danvers River (which joins the Atlantic at Beverly Harbor). Sa sheet.

stol County; town of Taunton; outlet, a short stream flowing
dding Pond on Mill River (tributary through Taunton River to
). Taunton sheet.

dlesex County; a small pond a mile south of East Pepperell;
tream a mile long flowing north to Reedy Meadow Brook (tribu-
hua River to the Merrimack) at East Pepperell. Groton sheet.

mpshire County; town of Worthington; rises 1½ miles northwest
enter; flows southeasterly 4 miles to Ringville, where it joins
o form Little River (tributary through Westfield River to the
hesterfield sheet.

RTH AND SOUTH.—Bristol County; town of Fall River; the North
10 small streams, none of which are named on the topographic
inage basin tributary to the South Pond contains three ponds on
est in addition to Stafford, Sawdy (Sandy on the map), and Devol
f North Pond at "full pond," 2.821 square miles; average depth,
atest depth, 26 feet. Area of South Pond, 2.423 square miles.
Pond is used for municipal supply of Fall River, but by far the
he water drawn from the ponds is used by the mills below the Troy
r development and mechanical purposes. Fall River sheet. A
ption of the basin of Watuppa ponds and of the use of the water at
contained in the report of the reservoir commission to the city
l River, dated July 10, 1902.

DS, EAST AND WEST.—Worcester County; about 3 miles west of
orth of Wachusett Reservoir. The ponds are connected by a stream
long. West Waushaccum Pond receives a stream about 3 miles long;
am about 2 miles long, which is called Waushacum Brook and which
e upper end of Wachusett Reservoir near the mouth of Stillwater
cester and Marlboro sheets and maps of Metropolitan Water District.

Middlesex County; rises about one-half mile southeast of Billerica,
bout 180 feet above sea level; flows southeastward 1 mile, then gen-
ard 1 mile into Shawsheen River (tributary to Merrimack River);
mouth. Lowell and Lawrence sheets.

–Middlesex County; just west of Winchester; connected by a very
n with another small pond on Aberjona River, and thus finds outlet
stic lakes to Mystic River, which discharges into Boston Bay. Boston

–Barnstable County; town of Sandwich; west of Snake Pond and 1 mile
est Dale. Falmouth sheet.

–Plymouth County; rises in Accord Pond near the village of Queen
ers; takes an irregular but in general northerly course and discharges
ham Bay; length from White Head to Accord Pond, about 10 miles;
ributary, stream from Cushing Pond. Abington and Boston Bay sheets.

OOK.—Worcester County; rises on the west slope of Rocky Hill, at alti-
t 750 feet above sea level; flows southeastward about 3½ miles, then
ward 2½ miles into North Branch of Nashua River (tributary through
iver to the Merrimack). Worcester and Marlboro sheets.

K.—Barnstable County; a tidal channel in the marsh northwest of
le Harbor. Barnstable sheet.

RIVER.—Plymouth County; rises in the town of Carver; flows north-
l to its junction with Taunton River (tributary to Narragansett Bay);
o head of Stony Brook, here considered the head of the river, 9 miles;
l tributaries, Green, Annasnappet, Colchester, Raven, and Bartlett
Middleboro sheet.

Wenham Lake.—Essex County; south of Wenham and about one-half mile sout Wenham Swamp; inlet, a small stream from the west; outlet, a small strea Miles River (tributary to Ipswich River); length, 1½ miles; maximum width, half mile. Salem sheet.

Wenham Pond.—Plymouth County; town of Carver; north of the village of Wenh outlet, Herring Brook to South Meadow Brook (head of Weweantic River, wh is tributary to Buzzards Bay). Middleboro sheet.

Wenuchus Lake.—Essex County; on the north side of the city of Lynn; inle stream from Wyoma Lake; outlet, a tributary of Saugus River forming part of drainage system of the city of Lynn; length, about one-half mile; maxi width, about one-fourth mile. Boston Harbor sheet.

West Branch.—Hampshire County; rises in the western part of the town of C mington; flows southeastward to West Chesterfield, where it joins Westfield R (tributary to the Connecticut); length, 7 miles; called Bronson Brook above mouth of Steven Brook. Chesterfield sheet.

West Brook.—Franklin County; rises (as Avery Brook) in the town of Conway; f southeastward 8 miles into Mill River (tributary to the Connecticut) at Westb village. Northampton sheet.

West Brook.—Franklin and Worcester counties; rises on the north slope of Be Hill, in the town of Orange; flows southeasterly to its junction with Millers R (tributary to the Connecticut), 1½ miles southwest of Athol, in Worcester Cou length, 7 miles; principal tributary, Chene Brook. Warwick sheet.

West Brook.—Hampden County; rises on the west slope of Mount Vision in Wilbraham mountains; flows southward 2 miles into Scantic Brook (tribu through Scantic River to the Connecticut) at Hampden. Palmer sheet.

West Brook.—Hampden County; town of Brimfield; a stream about 2½ miles flowing southward into Mill Brook (tributary to Quinebaug River, and through Shetucket and Thames rivers to Long Island Sound) near the villag Brimfield. Brookfield sheet.

Westfield Brook.—Berkshire County; rises one-half mile east of Windsor vill flows southward 1½ miles, then very irregularly eastward to Cummington in Ha shire County, where it joins Westfield River (tributary to the Connectic Becket and Chesterfield sheets.

Westfield Little River.—Hampden County; formed in the town of Russell by union of Pebble and Borden brooks. Pebble Brook, the continuation of the stream, rises in Blandford and flows southeasterly; below the mouth of Bor Brook Westfield Little River continues its southeasterly course to a point a southeast of Cobble Mountain, where it turns and flows northeastward 2 mile turns again abruptly and flows southeasterly to Westfield, where it unites Westfield River (tributary to the Connecticut). Gaging station 3 miles b confluence of Pebble and Borden brooks, at diversion dam of the Spring Water Works. Used as a source of water supply for the city of Springfield. pages 167–176 of this report. Sandisfield, Granville, and Springfield sheets.

Westfield River.—Berkshire, Franklin, Hampshire, and Hampden counties; near Savoy Center, in the town of Savoy, about 2,300 feet above sea level; southeasterly to the village of Swift River, thence southerly to Huntington, again southeasterly to its confluence with the Connecticut at Springfield; le from source to mouth, 55 miles; drainage area, 515 square miles; principal tr taries, Swift River, Middle and West branches of the Westfield, and West Little River. The basin is hilly and toward the headwaters mountain storage reservoirs neither numerous nor large; fluctuations in discharge ra Gaging stations at Knightville and Westfield on the main stream; at Goss Hei on the Middle Branch; and at Chester on the West Branch. Maps of b Greylock, Hawley, Becket, Chesterfield, Granville, and Springfield sheets. pages 150–181 of this report.

ɪᴅᴅʟᴇ **Bʀᴀɴᴄʜ.**—Berkshire and Hampshire counties; rises (as
e northern part of the town of Peru; flows southeasterly through
lefield, Worthington, and Chester to its junction with Westfield
:o the Connecticut); length, about 19 miles; drainage area, 53
:he head of the stream the altitude is about 2,200 feet above
it joins the main stream the elevation is 410 feet; principal
r Brook, Tuttle Brook, Den Stream, and Kinney and Day
ınd Chesterfield sheets.

'ᴇsᴛ **Bʀᴀɴᴄʜ.**—Berkshire and Hampshire counties; rises in the
;ton, 1,900 feet above sea level; flows southeasterly 22 miles
nd Chester to Huntington, where it joins Westfield River (tribu-
ıecticut); drainage area, 96 square miles; altitude of junction,
ɔrincipal tributaries, Factory, Walker, Sanderson, and Roaring
ıin contains a number of small ponds and reservoirs. Becket,
ıterfield, and Granville sheets.

ᴋ.—Franklin County; town of Leyden; rises in Windham County,
:hwestern part of Guilford; flows southwestward 2½ miles into
butary through Deerfield River to the Connecticut). Greenfield

ɔᴏᴋ.—Plymouth County; rises in the town of Brockton near
ts; flows in general somewhat east of south to its junction with
ibutary through Matfield River to Taunton River and thus to
.y) in West Bridgewater. The headwater stream is called Black
ıngth to head of Black Betty Brook, 5 miles. Dedham sheet.

ıouth County; town of Plymouth; the largest of a group of small
thwest of Billington Sea. Plymouth sheet.

:ester County; 2 miles north of Hudson; altitude 340 feet above
ɔt, a small stream flowing northward into a much larger stream
ssabet Brook and thus through Assabet and Concord rivers to the
Iarlboro sheet.

—A tidal channel connecting Westport Harbor with the ocean
ds Bay. The East Branch of Westport River, the principal stream
ough this channel, heads in the town of Freetown and flows south-
e ponds above Westport Mills; in this part of its course it is called
ι River; below Westport Mills the general course of the river is
Vestport Point, then westward to Westport Harbor, where it receives
ch; length, 20 miles. Fall River sheet.

Eᴀsᴛ Bʀᴀɴᴄʜ. *See* Westport River.

Wᴇsᴛ Bʀᴀɴᴄʜ.—Newport County, R. I., and Bristol County,
ɜar Bliss Corner in the town of Tiverton, R. I.; flows southeastward
arbor, where it joins the East Branch of Westport River and passes
tidal to Adamsville, R. I.; length above tidewater, about 5 miles.
eet.

'orcester County; rises 2 miles northeast of Grafton; flows south-
r Lake, southeastward to the north base of West Hill, thence south-
) Blackstone River (tributary through Seekonk River to Providence
ıus to Narragansett Bay); length, 12 miles; principal tributaries,
;er, Rock Meadow, and Meadow brook; called Miscoe Brook above
Blackstone sheet.

ᴛ **Bʀᴏᴏᴋ.**—Worcester County; rises on the northwest slope of Little
ountain; flows northwestward 2 miles to the reservoir in Westminster;
westward 1 mile into Ware River (tributary through Chicopee River
ɔcticut). Worcester sheet.

Weweantic River.—Plymouth County; rises in the extreme northern pa Carver; flows very irregularly southward into Buzzards Bay; called S Meadow Brook above junction with Beaver Dam Brook; length to head of S Meadow Brook, about 20 miles; principal tributaries below South Meadow B Beaver Dam, Rocky, Meadow, Double and Sampson brooks, and Sippican R tidal in its lower course. Plymouth, Middleboro, New Bedford, and Falm sheets.

Weweeder ponds.—Nantucket County; Nantucket Island; two small ponds a east of the southern end of Miacomet Pond; one of the numerous small pon the south shore of the island, separated from the ocean by a narrow baier bre Nantucket sheet.

Weymouth Back River.—Norfolk County; rises in the swamp northeast of Abington, and flows northwestward through Great Pond, thence northwar northeastward (as Mill River) into Whitman Pond, then in general north into Hingham Bay; principal tributary, Old Swamp River, which disch into Whitman Pond; length from Weymouth to head near West Abington, a 10 miles; tidal to East Weymouth. Abington and Boston Bay sheets.

Weymouth Fore River.—Norfolk County; rises on Great Blue Hill in a small about 400 feet above sea level; flows irregularly eastward and southeast about 6 miles, then in a general northeasterly course into Hingham Bay; l course tidal; length from Ferry Point to source, about 13 miles; principal t taries, a stream which drains the southeastern part of the town of Randolph the western part of Holbrook, streams from Great and Little ponds, Haywood Ruggles creeks, and Town River. Dedham, Abington, and Boston Bay sh

Whatchaug Brook.—Hampden County; rises on the west slope of the Wilbr Mountains; flows southwestward 3 miles to the southeastern part of the tov Long Meadow, then southeastward 2½ miles to North Somers, Conn., whe joins Scantic Brook to form Scantic River (tributary to the Connecticut); le north of the Massachusetts line, about 4 miles. Palmer sheet.

Wheeler Brook.—Berkshire County; a stream about a mile long, flowing s eastward into Huntersfield Brook (tributary through North Branch of H River to Hoosic River and thus to the Hudson) at North Adams. Greylock s

Wheeler Brook.—Berkshire County; town of Florida; a stream 1 mile long flo southeastward into Cold River (tributary through Deerfield River to the Con ticut) 2½ miles west of its mouth. Hawley sheet.

Wheeler Brook.—Hampden County; town of Blandford; a stream about a mile flowing easterly into Pebble Brook and thus to Springfield reservoir on West Little River. *See* Westfield Little River. Granville sheet.

Whetstone Brook.—Franklin County; town of Wendell; rises 1½ miles southe the village of Wendell; flows in general east of north to its junction with M River (tributary to the Connecticut) near Wendell Depot; about 4 miles Warwick sheet.

Whitcomb Brook.—Berkshire County; town of Florida; rises near the villa Florida; flows southeastward 2½ miles into Deerfield River (tributary to Connecticut) at Hoosac Tunnel. Greylock and Hawley sheets.

White Brook.—Hampden County; town of Agawam; a stream less than a mile flowing northward into Westfield River (tributary to the Connecticut). Sp field sheet.

White Island Pond.—Plymouth County; towns of Plymouth and Wareham; ou Red Brook to Buttermilk Bay and thus to Buzzards Bay; a large pond of irregular outline. Plymouth sheet.

White Lily Pond.—Berkshire County; 2 miles north of Benton Lake in the to Otis, to which it discharges by a southward flowing stream and through wh is tributary to Otis reservoir, Farmington River, and the Connecticut. Sa field sheet.

ROOK.—Worcester County; a stream about half a mile long, flowing
from the east slope of Mount Hunger into Stodgemeadow Pond. Fitch-
.

–Barnstable County; 1 mile northwest of North Harwich. Yarmouth

–Middlesex County; 2½ miles east of Maynard, and 1½ miles south of
altitude, about 160 feet above sea level; about 1½ miles east of Sud-
r (tributary through Concord River to the Merrimack); very small.
m sheet.

–Middlesex County; 3 miles southwest of Maynard and 2 miles south
River (tributary through Concord River to the Merrimack). Framing-

–Worcester County; town of Athol; 1½ miles north of South Athol;
ıwood Brook; outlet, a stream one-half mile long flowing westward into
oir on the Worcester-Franklin county line south of Eaglesville. The
om this reservoir passes northward to Millers River (tributary to the
ıt). Warwick sheet.

-Worcester County; town of Lancaster; discharges by a stream about
hs mile long, flowing westward into North Branch of Nashua River
through Nashua River to the Merrimack). Groton sheet.

—Plymouth County; town of Plymouth; one of a group of small ponds
heastern part of the township between White Island Pond and Great
nd. Plymouth sheet.

.—Norfolk County; 1 mile west of Wrentham; several small inflowing
tlet, a stream 5 miles long flowing in general northward into Charles
tude, about 200 feet above sea level. Franklin sheet.

R.—Berkshire County, Mass.; Litchfield County, Conn.; rises in the
w Marlboro; flows southwesterly to East Canaan village in the town of
aan, Conn., where it joins Blackberry River (tributary to the Housa-
gth, about 9 miles, of which 6 miles is north of the Massachusetts-
t boundary. Sandisfield and Sheffield sheets.

.—Worcester County; a large pond on Mumford River (tributary to
River and thus through Seekonk and Providence rivers to Narra-
y) west of Whitinsville. In addition to Mumford River the pond
rgatory Brook and several smaller streams. Blackstone sheet.

D.—Norfolk County; near East Weymouth; principal inflowing stream,
(considered head of Weymouth Back River) and Old Swamp River;
ymouth Back River; altitude, about 60 feet above sea level. Abing-

ROOK.—Hampshire County; town of Cummington; a stream 2 miles
g southeastward into Bronson Brook, the head of West Branch (tribu-
h Westfield River to the Connecticut). Chesterfield sheet.

D.—Worcester County; at Winchendon; on Millers River (tributary to
t River); principal inlet, in addition to Millers River, stream from
monac. Winchendon sheet.

Y POND.—Norfolk County; town of Weymouth; west of south end of
Pond; outlet, a stream one-fourth mile long flowing westward into
(Weymouth Back River). Abington sheet.

ND.—Worcester County; west of West Brookfield in the town of West
; inlet, Mill Brook; outlet, Mill Brook to Quaboag River (tributary
icopee River to the Connecticut). The pond is nearly 2 miles long
lf mile in maximum width, and the stream connecting it with the
about one-eighth mile long. Barre and Brookfield sheets.

Wickett Brook.—Franklin County; town of Wendell; rises in Wickett Pond; northwestward into Millers River (tributary to the Connecticut); length, 3 m Warwick sheet.

Wickett Pond.—Franklin County; town of Wendell; outlet, Wickett Brook to M River (tributary to the Connecticut); nearly a mile long; about one-eighth wide. Warwick sheet.

Wiggins Pond.—Plymouth County; town of Plymouth; 1 mile southwest of South Pond. Plymouth sheet.

Wight Pond.—Norfolk County; northern part of town of Dedham; one inlet; ou a stream about 2 miles long flowing east and north into Charles River in Dedl very small. Dedham sheet.

Wigwam Brook.—Worcester County; rises in a pond north of Wigwam Hill; northwestward into Meadow Brook (tributary through West River to Black River and thus through Seekonk and Providence rivers to Narragansett 1½ miles long. Blackstone sheet.

Wigwam Pond.—Nantucket County; Nantucket Island; south shore; separated the ocean by a narrow beach. Nantucket sheet.

Wigwam Pond.—Norfolk County; town of Dedham; one inlet from Little Wig Pond; outlet, a stream flowing northward to the stream connecting Wight with Charles River at Dedham. Dedham sheet.

Wild Cat Brook.—Plymouth County; rises in the town of Norwell near Burnt Swamp; flows in general southward to its junction with Third Herring B (tributary to North River); length, 3 miles. Abington sheet.

Wilder Brook.—Worcester County; rises 1½ miles southwest of North Ashburn station; flows southwestward 3 miles into a pond on Kneeland Brook (tribu through Otter River to Millers River and thus to the Connecticut). Fitch and Winchdon sheets.

Wilder River.—Franklin County; rises 1 mile north of Pocumtuck Mountain; southerly 3½ miles into Deerfield River (tributary to the Connecticut) near Charlemont. Hawley sheet.

Willard Brook.—Berkshire County; rises in the western part of the town of S field; flows east of north 3½ miles to Hubbard Brook (tributary through Sch Brook to Housatonic River); principal tributaries, streams from Spur Lake Harman Marsh Pond. Sheffield sheet.

Willard Brook.—Middlesex County; rises in the town of Ashby, in the rese 2 miles southwest of Mill Village; flows in general north of east to the lower of Ash Swamp which is drained through Squannacook River to Nashua R and thus to the Merrimack; principal tributary, Trap Fall Brook; length, a 6 miles. Fitchburg sheet.

Williams Pond.—Middlesex County; just west of Marlboro; altitude about 420 above sea level; outlet, Millham Brook (tributary through Assabet River to cord River and thus to the Merrimack); about one-fourth mile long and one- mile in maximum width. Marlboro sheet.

Williams River.—Berkshire County; rises in Shaker Mill Pond, in the northern of the town of West Stockbridge; this pond receives three large streams—C Griffin, and Flat brooks. Flat Brook, which drains the largest area and is th fore considered the continuation of Williams River, rises in the eastern pa the town of Canaan in Columbia County, N. Y.; flows west of south 2½ miles, southeasterly about 4 miles to Shaker Mill Pond, crossing the New York-M chusetts boundary at State line; from Shaker Mill Pond, Williams River southward 9 miles to Van Dausenville in Great Barrington, where it enters Ho tonic River. The river has no important tributaries below Shaker Mill P Pittsfield and Sheffield sheets.

D.—Middlesex County; in a swamp 2 miles south of Maynard; inlet Run
outlet, Run Brook to Hop Brook (tributary through Wash Brook to Sud-
ver and thus through Concord River to the Merrimack); altitude, 180 feet
a level; small. Framingham sheet.

D RESERVOIR.—Worcester County; 2 miles south of the village of Man-
hree inflowing streams, including one from Bad Luck Pond (north of Wad-
); outlet, a stream 2 miles long flowing northeastward into Mumford River
ry to Blackstone River and thus through Seekonk and Providence rivers
gansett Bay). Webster sheet.

OOK.—Middlesex County; rises about 1 mile north of Woburn, at altitude
above sea level; flows generally northeastward about 1½ miles into Mystic
vhich discharges into Boston Bay) a short distance above Richardson
Lawrence sheet.

K.—Middlesex County; rises 2 miles southeast of North Reading, at alti-
feet above sea level; flows somewhat southwestward 1 mile into Ipswich
Lawrence sheet.

OOK.—Franklin County; town of Warwick; a stream about 2 miles long,
outheastward into Moss Brook (tributary through Millers River to the
cut) just below the outlet of Lake Moore. Warwick sheet.

RESERVOIRS.—Middlesex County; about half a mile east of Winchester;
e water storage system of Winchester and vicinity. Boston sheet.

ND.—Berkshire County; northeastern part of the town of Windsor, inlet
oked Pond; outlet, a stream 2 miles long flowing westward and south-
Westfield River (tributary to the Connecticut). Hawley sheet.

.—Worcester County; town of Phillipston; a stream 2 miles long flowing
d into Burnshirt River (tributary through Ware River to Chicopee River
to the Connecticut) at the lower end of the swamp east of East Phillips-
nchendon sheet.

BROOK.—Worcester County; town of New Braintree; a stream 2 miles
ing northward into Ware River (tributary through Chicopee River to
ecticut). Barre sheet.

T POND.—Bristol County; 4 miles northwest of the city of Taunton;
noe River (head of Mill River) and Mulberry Meadow Brook; outlet,
r to Taunton River (tributary to Narragansett Bay); pond is nearly a
and half a mile wide. Taunton sheet.

OND.—Middlesex County; a very small pond 1½ miles southwest of
altitude, 180 feet above sea level; outlet, a small stream one-half mile
ng eastward into Concord River (tributary to the Merrimack). Lowell

K.—Middlesex County; rises near the village of Belmont, about a mile
rlington Heights, at altitude about 200 feet above sea level; flows gen-
tward about 1½ miles into Little Pond (tributary through Little River
Brook and thus to Mystic River). Boston sheet.

.—Middlesex County, a small pond on the west edge of Winchester;
divide very near one of the inlets to Horn Pond (tributary through a
m and Wedge Pond to Aberjona River, which flows through the Mystic
Mystic River). Boston sheet.

ND.—Middlesex County; one-half mile south of Holliston; two small
streams; outlet, a stream 1½ miles long flowing northward into Bogastow
butary to Charles River) at East Holliston; altitude, about 170 feet.
heet.

.—Middlesex County; rises in the swamp about 2½ miles southwest of
Harbor; flows northeastward into Squannacook River (tributary through
iver to the Merrimack). Groton sheet.

Wolf Brook.—Middlesex County, Mass., Hillsboro County, N. H.; rises in Swamp on the northwest slope of Townsend Hill, at altitude about 350 feet; northeastward 3 miles into Nissitisset River (tributary through Nashua Ri the Merrimack) in the town of Brookline, N. H. Groton sheet.

Wolf Plain Brook.—Bristol County; town of Rehoboth; a stream about 2 miles flowing southeastward into Bliss Brook (tributary through Palmer River to ren River and thus to Narragansett Bay) at Perryville Reservoir. Provi sheet.

Wood Pond.—Hampden County; a small pond 1 mile northeast of Ludlow and a mile north of Chicopee River (tributary to the Connecticut). Palmer sh

Woods Brook.—Plymouth County; town of Middleboro; rises about 1 mile no Woods Pond; flows southward through the pond into Fall Brook (tributary th Namasket River and Taunton River to Narragansett Bay); length, about 3 Middleboro sheet.

Woods Pond.—Plymouth County; town of Middleboro; inlet and outlet, Brook (tributary through Fall to Namasket River and thus through Ta River to Narragansett Bay). Middleboro sheet.

Workman Brook.—Franklin County; rises 2 miles northeast of East Shelburne; southeastward 1 mile, then northeastward 1 mile into Green River (trib through Deerfield River to the Connecticut). Greenfield sheet.

Worthington Brook.—Hampden County; town of Agawam; rises in the southea part of the township; flows southeasterly 1¼ miles, then northeasterly ab mile into Threemile Brook (tributary to Connecticut River). Springfield

Wrangling Brook.—Middlesex County; rises 1 mile northeast of West Groton; southeastward 1 mile, then northeastward 1 mile into Nashua River (trib to the Merrimack). Groton sheet.

Wright Brook.—Berkshire County; rises between Mount Ethel and Mount Ste in the northeastern parts of the town of Mount Washington; flows southe miles, then southwesterly 1 mile into Bashbish Brook (tributary through Jansen Kill to the Hudson). Sheffield sheet.

Wright Brook.—Middlesex County; rises one-half mile south of Fox Hill and east of Billerica, at altitude about 110 feet above sea level; flows southeas 2 miles into Shawsheen River (tributary to the Merrimack) about 3 miles Wilmington Center; marshy through the lower part of its course. Law sheet.

Wright Ponds.—Middlesex County; southern part of town of Ashby; two small which are connected by a short stream and which discharge by a stream 2 long flowing southeast into Pearl Hill Brook (tributary through Squann River to Nashua River and thus to the Merrimack). Fitchburg sheet.

Wright River.—Hampshire County; town of Williamsburg; rises (as Potash on the south slope of Walnut Hill; flows somewhat east of south 2 miles, southwesterly one-half mile into Mill River (tributary to the Connect Northampton sheet.

Wyoma Lake.—Essex County; about a mile northwest of the city of Lynn; in small marshy stream flowing southeastward about a mile through two small outlet, a small stream to Wenuchus Lake and thus to a tributary of Saugus The tributary forms a part of the drainage system of the city of Lynn. Len lake, about three-fourths mile; width about one-eighth mile; elevation 8 Salem and Boston Harbor sheets.

Yokum Pond.—Berkshire County town of Becket; a mile east of Becket Mou outlet to a stream that enters West Branch of Westfield River (tributary th Westfield River to the Connecticut) at Becket. Becket sheet.

Yokun River.—Berkshire County; town of Lenox; rises between Lenox Mou and Baldhead; flows northeastward 3 miles, then southeasterly about 3 mi its junction with Housatonic River a mile south of New Lenox. Pittsfiel Becket sheets.

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DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 416

THE DIVINING ROD

A HISTORY OF WATER WITCHING

WITH A BIBLIOGRAPHY

BY

ARTHUR J. ELLIS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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WASHINGTON, D. C.
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INTRODUCTORY NOTE.

By O. E. Meinzer.

he use of a forked twig, or so-called divining rod, in locating erals, finding hidden treasure, or detecting criminals is a curious erstition that has been a subject of discussion since the middle he sixteenth century and still has a strong hold on the popular d, even in this country, as is shown by the large number of inqui- received each year by the United States Geological Survey as to efficacy, especially for locating underground water, and the per- ent demands that it be made a subject of investigation by the vey. The bibliography shows that a truly astonishing number ooks and pamphlets have been written on the subject. The pose of the present brief paper is not to add another contribution his enormous volume of uncanny literature but merely to furnish ply to the numerous inquiries that are continually being received n all parts of the country. The outline of the history of the sub- presented in the following pages will probably enable most est inquirers to appreciate the practical uselessness of "water ching" and other applications of the divining rod, but those wish to delve further into the mysteries of the subject are rred to the literature cited in the bibliography, in which they will l reports in painful detail of exhaustive investigations and pseudo- estigations of every phase of the subject and every imaginable lanation of the supposed phenomena.

t is doubtful whether so much investigation and discussion have n bestowed on any other subject with such absolute lack of posi- e results. It is difficult to see how for practical purposes the ire matter could be more thoroughly discredited, and it should be vious to everyone that further tests by the United States Geo- ical Survey of this so-called "witching" for water, oil, or other nerals would be a misuse of public funds.

A large number of more complicated devices for locating water other minerals are closely related to the forked twig. A favorite ck for appealing to uneducated persons and yet making specific proof impossible is to give as the working principle of such a device ne newly discovered and vaguely understood phenomenon, as, for ample, radioactivity. Many such devices have been in existence

since the seventeenth century, and almost without ex
claims that are made for them are very great. If a
instrument were invented its merits would no doubt in t
well recognized, as have those of other real inventions.
netic needle used in detecting iron ore is, of course, not
this category of spurious instruments.

It is by no means true that all persons using a forked t
other device for locating water or other mineral are
deceivers. Some of them are doubtless men of good ch
benevolent intentions. However, as anything that can
veiled in mystery affords a good opportunity for swin
can be no reasonable doubt that many of the large grou
sional finders of water, oil, or other minerals who take p
"services" or for the sale of their "instruments" are
defrauding the people, and that the total amount of n
obtain is large.

To all inquirers the United States Geological Surve
gives the advice not to expend any money for the serv
"water witch" or for the use or purchase of any machin
ment devised for locating underground water or other mi

HE DIVINING ROD: A HISTORY OF WATER WITCHING.

By Arthur J. Ellis.

FORM OF THE DIVINING ROD.

In its most familiar form the so-called divining rod is a forked twig, ne fork of which is usually held in each hand in such a manner that ne butt end of the twig normally points upward (figs. 1 and 2). The upposition is that when arried to a place beneath hich water or other min- als lie, the butt end will e attracted downward, or, ccording to some diviners, ill whirl round and round. here are many modifica- ions in both the form and ne manipulation of the evice. For instance, a traight twig may be held t the small end, allowing ne butt end to bob up and own, the number of bobs being taken to indicate the depth to water r ore in fathoms or feet or other common unit of measure.

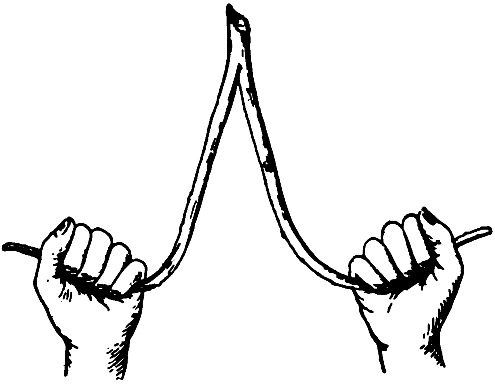

FIGURE 1.—Ordinary divining rod held in the usual manner.

The opinion as to the kind of wood of which the twig should consist as differed greatly at different times and places, but peach, willow, hazel, and witch hazel are common favorites. By some diviners the twig is cut indiscriminately from any kind of tree, or the device is made of metal or is some common implement, such as a buggy whip. Formerly incantations were used in connection with the divining rod.

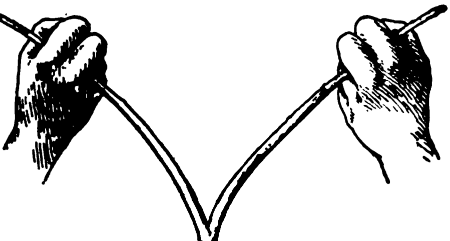

FIGURE 2.—Less common manner of holding the divining rod.

Some diviners appear to pass into abnormal or psy- hical states and have muscular spasms, such as occur in cases of ysteria, which, it is contended, can not be repeated at will by the diviner when he returns to a normal state. Under such co the twig may not only rotate, but one fork may be completel off by the force with which it is driven round and round.

Divining rods have been put to a wide variety of uses s superstition first became popular, and it is not uncomm at the present time to find them used by a single person t diverse results, among which there is no conceivable relati example, Henri Mager purports to use the rod to detect the of water and ores and ure their depth be surface, to analyze w ores, to determine t tions of the cardinal p measure the height and to perform other (See p. 23.) In tra history of the subj found that divining r been used for all of th ing purposes: (1) T ore deposits, (2) to buried or hidden trea to find lost landma reestablish property ries, (4) to detect c (5) to analyze person acter, (6) to cure dise to trace lost or stra mestic animals, (8) t immunity against ill when preserved as (9) to locate well s to trace the courses derground streams, determine the amount of water available by drilling at a gi (12) to determine the depth at which water or ores occur, determine the direction of cardinal points, (14) to deter heights of trees, and (15) to analyze ores and waters.

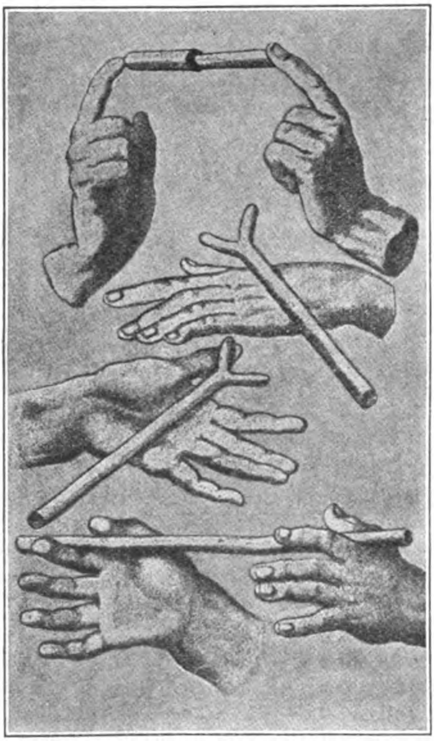

FIGURE 3.—Various old types of divining rods and the ways in which they were held. (After Vallemont, 1693.)

ORIGIN OF THE DIVINING ROD.

The origin of the divining rod is lost in antiquity. Stu the subject have discovered in ancient literature many mor vague references to it, and though it is certain that rods o of some kind were in use among ancient peoples for forecastin and searching for lost objects, and in occult practices general known of the manner in which such rods were used or what lation, if any, they may have to the modern device. The "rod" mentioned many times in the Bible in connection with miraculous rformances, especially in the books of Moses. The much-quoted ssage describing the "smiting of the rock" (Numbers xx, 9–11) s been regarded by enthusiasts of water witching as a significant ference to the divining rod,[1] as have also the following passages: My people ask council at their stocks, and their staff declareth ito them" (Hosea iv, 12); and "The king of Babylon stood at the rting of the way, at the head of two ways, to use divination; he ade his arrows bright," etc. (Ezekiel xxi, 21).

The following paragraphs are quoted from Rossiter Raymond's say[2] on the use of rods for divination:

> The Scythians, Persians, and Medes used them. Herodotus says that the Scythians tected perjurers by means of rods. The word rhabdomancy,[3] originated by the eeks, shows that they practiced this art; and the magic power of the rods of Minerva, rce, and Hermes or Mercury is familiar to classical students. The lituus of the mans, with which the augurs divined, was apparently an arched rod. Cicero, who l himself been an augur, says, in his treatise on divination, that he does not see v two augurs, meeting in the street, could look each other in the face without ghing. At the end of the first book of this treatise he quotes a couplet from the Latin poet Ennius, representing a person from whom a diviner had demanded a as replying to this demand, "I will pay you out of the treasures which you enable to find." * * *
>
> Marco Polo reports the use of rods or arrows for divination throughout the Orient, l a later traveler describes it among the Turks. Tacitus says that the ancient rmans used for this purpose branches of fruit trees. One of their tribes, the Frisians, ployed rods in church to detect murderers. Finally, if we may trust Gonsalez Mendoza, the Chinese, who seem to have had everything before anybody else, d pieces of wood for divination.
>
> Thus we perceive that the application of the divining rod in historical antiquity s mainly or wholly moral—that is, it was employed to detect guilt, decide future nts, advise courses of action, etc. There are but two passages which have been oted to prove its use for physical purposes; one from Ctesias (Apud phot. bibl. l.), who speaks of a rod of the wood Parebus, which attracted gold, silver, other tals, stones, and several other things; the other from Cicero (De Officiis, lib. I), o says, "If we could obtain with the so-called divine rod everything pertaining to d and clothing (ad victum cultumque)," etc.[4]
>
> On the other hand, the silence of many authors is significant, as Chevreul has pointed . Varro does not mention the use of the rod for the discovery of subterranean ters or metals. Vitruvius, discussing the means of discovering springs, says nothing t. Pliny, in Book XXX of his Natural History, omits it from his enumeration of gical arts and methods, and in Book XXXI, describing (after Vitruvius) the means discovering springs, and Book XXXIII, describing explorations for metals, is ually silent concerning it. Columella, Palladius, and in the sixth century Cassio-

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Latimer, Charles, The divining rod, p. 20, 1876.

Raymond, R. W., The divining rod: Am. Inst. Min. Eng. Trans., vol. 11, pp. 415–416, 1883. See also . Geol. Survey Mineral Resources, 1882, pp. 610–626, 1883.

Rhabdomancy, from the Greek ῥάβδος, rod, and μαντεία, divination, is the practice of searching for ngs, well sites, precious metals, and other things concealed in the earth by means of a divining rod.

This reference in complete form reads as follows: "If all that is needful for our nourishment and support ves to us by means of some divine rod, as people say, then each of us, free from all care and trouble, give himself up to the exclusive pursuit of study and science."

dorus are likewise dumb, though the latter in one of his epistles (The
extols the utility of the professional water discoverers.

Whatever significance one may attach to such referenc
cited above, no conclusive evidence has been found of the
divining rod as it is now known earlier than the first half
teenth century. What is believed to be the first publish
tion of the rod is contained in Georgius Agricola's "De re
which was begun about 1533 and was published in 15
is a striking similarity between some of the ideas expres
account and some of those now held regarding the rod a
which, it is believed, justify its quotation. The following
are quoted from the Hoover translation:[1]

> There are many great contentions between miners concerning the for
> some say that it is of the greatest use in discovering veins, and others deny
> those who manipulate and use the twig first cut a fork from a hazel
> knife, for this bush they consider more efficacious than any other for rev
> especially if the hazel bush grows above a vein. Others use a different ki
> each metal, when they are seeking to discover the veins, for they employ h
> veins of silver; ash twigs for copper; pitch pine for lead and especially
> made of iron and steel for gold. All alike grasp the forks of the twig with
> clenching their fists, it being necessary that the clenched fingers sho
> toward the sky in order that the twig should be raised at that end w
> branches meet. Then they wander hither and thither at random through
> regions. It is said that the moment they place their feet on a vein the
> diately turns and twists, and so by its action discloses the vein; when the
> feet again and go away from that spot the twig becomes once more imm
>
> The truth is, they assert, the movement of the twig is caused by the
> veins, and sometimes this is so great that the branches of trees growing
> are deflected toward it. On the other hand, those who say that the twi
> to good and serious men, also deny that the motion is due to the power
> because the twig will not move for everybody, but only for those who e
> tations and craft. Moreover, they deny the power of a vein to draw
> branches of trees, but they say that the warm and dry exhalations
> contortions. Those who advocate the use of the twig make this reply to
> tions: When one of the miners or some other person holds the twig in his
> is not turned by the force of the veins, this is due to some peculiarity of th
> which hinders and impedes the power of the vein, for since the power o
> turning and twisting the twig may be not unlike that of a magnet at
> drawing iron toward itself, this hidden quality of a man weakens an
> force, just the same as garlic weakens and overcomes the strength of a ma
> magnet smeared with garlic juice can not attract iron, nor does it attra
> when rusty. Further, concerning the handling of the twig, they war
> should not press the fingers together too lightly, nor clench them too firm
> twig is held lightly they say that it will fall before the force of the vein c
> however, it is grasped too firmly the force of the hands resists the force of
> counteracts it. Therefore, they consider that five things are necessary t
> the twig shall serve its purpose: of these the first is the size of the twig, fo
> the vein can not turn too large a stick; secondly, there is the shape of the
> must be forked or the vein can not turn it; thirdly, the power of the vei
> the nature to turn it; fourthly, the manipulation of the twig; fifthly, th

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[1] Agricola, Georgius, De re metallica, translated from first Latin edition of 1556 by H
Hoover, pp. 38-41, 1912.

ding peculiarities. These advocates of the twig sum up their conclusions as
ws: If the rod does not move for everybody, it is due to unskilled manipulation or
e impeding peculiarities of the man which oppose and resist the force of the
, as we said above, and those who search for veins by means of the twig need not
ssarily make incantations, but it is sufficient that they handle it suitably and are
id of impeding power; therefore, the twig may be of use to good and serious men
scovering veins. With regard to deflection of branches of trees they say nothing
adhere to their opinion.

nce this matter remains in dispute and causes much dissension amongst miners, I
ider it ought to be examined on its own merits. The wizards, who also make use
ngs, mirrors, and crystals, seek for veins with a divining rod shaped like a fork;
ts shape makes no difference in the matter—it might be straight or of some other
—for it is not the form of the twig that matters [see fig. 3], but the wizard's incan-
ns which it would not become me to repeat, neither do I wish to do so. The
ents, by means of the divining rod, not only procured those things necessary for a
ihood or for luxury, but they were able also to alter the forms of things by it; as
n the magicians changed the rods of the Egyptians into serpents, as the writings
e Hebrews relate; and as in Homer, Minerva with a divining rod turned the aged
sses suddenly into a youth and then restored him back again to old age; Circe
changed Ulysses' companions into beasts, but afterward gave them back again
r human forms; moreover, by his rod, which was called "Caduceus," Mercury
sleep to watchmen and awoke slumberers. Therefore it seems that the divining
passed to the mines from its impure origin with the magicians. Then when
men shrank with horror from incantations and rejected them, the twig was re-
ed by the unsophisticated common miners, and in searching for new veins some
es of these ancient usages remain.

ut since truly the twigs of the miners do move, albeit they do not generally use
ntations, some say this movement is caused by the power of the veins, others say
it depends on the manipulation, and still others think that the movement is due to
n these causes. But, in truth, all those objects which are endowed with the power
ttraction do not twist things in circles, but attract them directly to themselves;
nstance, the magnet does not turn the iron but draws it directly to itself, and
er rubbed until it is warm does not bend straws about, but simply draws them to
f. If the power of the veins were of a similar nature to that of the magnet and
amber, the twig would not so much twist as move once only, in a semicircle,
be drawn directly to the vein, and unless the strength of the man who holds the
were to resist and oppose the force of the vein the twig would be brought to the
nd; wherefore, since this is not the case, it must necessarily follow that the manip-
ion is the cause of the twig's twisting motion. It is a conspicuous fact that these
ning manipulators do not use a straight twig but a forked one cut from a hazel
n or from some other wood equally flexible, so that if it be held in the hands, as
y are accustomed to hold it, it turns in a circle for any man wherever he stands.
is it strange that the twig does not turn when held by the inexperienced, because
y either grasp the forks of the twig too tightly or hold them too loosely. Never-
ess, these things give rise to the faith among common miners that veins are dis-
ered by the use of twigs, because whilst using these they do accidentally discover
e; but it more often happens that they lose their labour, and although they might
over a vein, they become none the less exhausted in digging useless trenches
n do the miners who prospect in an unfortunate locality. Therefore a miner, since
think he ought to be a good and serious man, should not make use of an enchanted
, because if he is prudent and skilled in the natural signs he understands that a
ed stick is of no use to him, for, as I have said before, there are the natural indica-
s of the veins which he can see for himself without the help of twigs. So if Nature
chance should indicate a locality suitable for mining, the miner should dig his
nches there; if no vein appears he must dig numerous trenches until he discovers
outcrop of a vein.

There are two accounts of earlier date than "De re m which are mentioned in most histories of the divining rod. these accounts is contained in the "Novum testamentum" of Valentinus, a Benedictine monk of the fifteenth century, who seven chapters of the second book of his work to a didactic of the use of the divining rod. But there is some confusion date and as to the authorship of this book, and Raymond p that the existence even of Basilius Valentinus is not beyon Gadenus states, in his "Historia Erfordiensis" (1675), that was living at St. Peter's convent at Erfurth in 1413, but th copy of the "Testamentum," which is a French translation script, is dated 1651, and the book was not printed until al years after Agricola. The other account is contained in "D rerum," IX, by Paracelsus, which was no doubt written "De re metallica," for Paracelsus died in 1541, but it was lished until some time later. From this account Hoover[1] c

> These [divinations] are vain and misleading, and among the first of them a rods, which have deceived many miners. If they once point rightly th ten or twenty times.

Barrett[2] considers it practically certain that the birthpla modern divining rod is in the mining districts of Germany, pr the Harz Mountains, where the most approved mining were first devised. He says:

> Possibly they were led to its use from the belief, once universal amon men like Melanchthon, that metallic ores attracted certain trees which drooped over the place where those ores were to be found, the drooping no d due to the soil or other causes. A branch of the tree was therefore cut and where it drooped; later on a branch was held in each hand and the extre together, as shown in an old Italian plate [See fig. 4]; finally, for conv forked branch was cut, the two ends grasped one in each hand with paln the arms of the holder were then brought to the side of the body, so that rod was held in somewhat unstable equilibrium, and the "diviner" set f quest with, in old time, certain solemnities and invocations.

At any rate the divining rod came into common use first in as a means for locating mines and also for discovering buried a matter of rather common interest in those days, when the of burying money and plate for safe keeping was so general.

SPREAD OF THE DELUSION.

German miners were imported into England during the Elizabeth (1558–1603) to lend an impetus to the industry in which had been passing through a period of depression. the divining rod was introduced into England, and before th the seventeenth century it had spread through the cou Europe. Everywhere it aroused controversy. Its champion iom were some of the most learned men of the time, explained its eration, as, indeed, they explained nearly all facts of physics and emistry, on the principle of "sympathy" or "attraction and re- lsion." The common phenomena of gravity and magnetism ubtless suggested this interpretation. Philippe Melanchthon, in his Discours sur la sympathie," 15—?; his son-in-law, Gaspar Peucer, "Les devins," 1584 (book 13, ch. 10); Porta, in "Magiae naturalis,"

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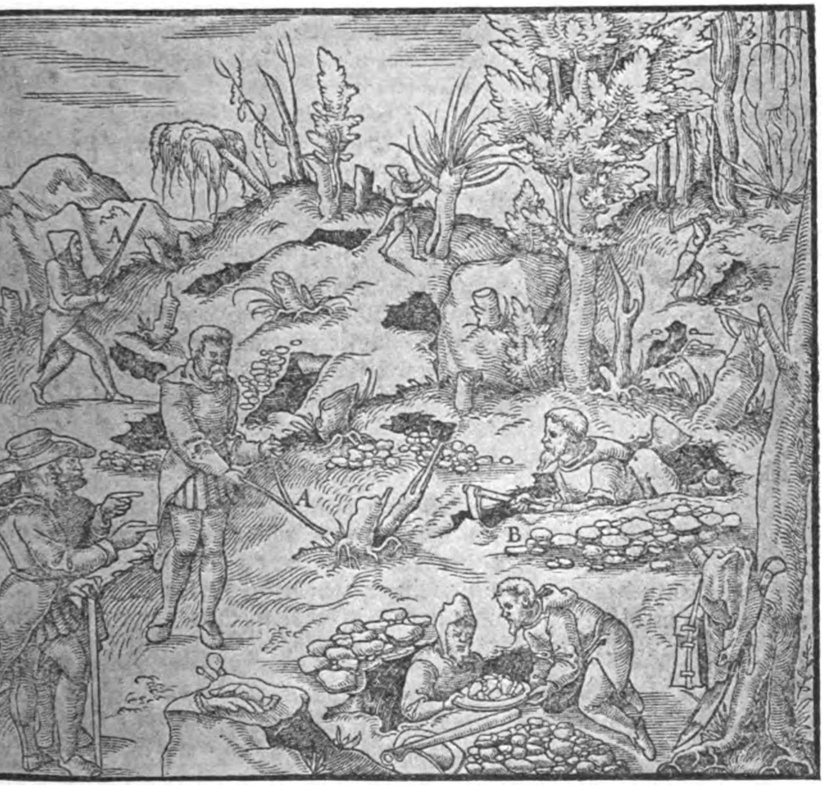
[1] Hoover, H. C. and L. H., Agricola, De re metallica, p. 38, 1912.

[2] Barrett, W. F., Soc. Psych. Res. Proc., vol. 13, p. 13, 1897–98.



GURE 4.—Use of divining rods in prospecting for ore. A, Twig; B, trench. (From Agricola, De re metallica, German edition, 1580.)

569 (book 1, ch. 8); Keckermann (1573-1609) in "Systemata physica" ook 1, ch. 8); and Michel Mayer, in "Verum inventum," 1619 (ch.), attribute the action of the divining rod to "sympathetic affinity."

The adversaries of the divining rod, on the other hand, like Para- lsus and Agricola, condemned its use as a superstitious and vain ractice, without attempting to refute the specific arguments ad- anced by their opponents or flatly denying its supernatural con- ections.

A third view was that involving a demoniac influence, and Ray- ond suggests that the adversaries of the rod, including Agricola,

may have adopted their attitude of reserve on the question
influences from a desire to avoid possible serious con
Another view, closely related to that of satanic influen
scribed by Raymond[1] as follows:

> A fourth view was indeed advanced, according to which the operator, a
> rod, was the recipient of a divinely given faculty. It was no doubt with
> of avoiding the odium attached to dealings with the Evil One that the
> this science, particularly in Germany, surrounded it with ceremonies a
> of a highly pious character. It is true that the rules sometimes prescribe
> ting of the twig partook largely of heathen sorcery and astrology. They we
> some extent, unconscious reminiscences of the old Scandinavian, and
> Aryan mythology. But this was atoned for when the rod was duly Chri
> baptism, being laid for this purpose in the bed with a newly baptized chi
> Christian name it was afterward addressed. The following formula, cited
> mann, may serve as an example: "In the name of the Father and of the So
> Holy Ghost, I adjure thee, Augusta Carolina, that thou tell me, so pure
> Mary the Virgin was, who bore our Lord Jesus Christ, how many fathon
> here to the ore?" In this case, the rod was expected to reply by dippi
> number of times, corresponding to the number of fathoms,

It is readily conceivable that the motive for surrounding
tice with a religious atmosphere might not have been alt
belief in its divine character, for at that time anyone found
in mysterious works was in danger of being charged with so
burned to death.

In Cornwall the belief was common among the miners
persists as a tradition, that the divining rod was guided
deposits by the pixies, the fairy custodians of the mineral
of the earth.

Not only did the abstract discussion of this subject engage
tion of persons in all classes of society, but nobles and peasan
and philosophers—representatives from every class—busi
selves trying to locate ore deposits by means of forked twigs
bly the most prominent diviners at this time were Baron de
(Jean-Jacques de Chatelet), 1576–1643, and his wife.
who was one of the foremost mining authorities of his day
extensively through the mining regions of Europe, visited
in his study of mining, and received important commissi
dukes and emperors, and even from the Pope. His wife s
responsibilities and honors. But later they fell from favo
the machinations of rivals, and the fact that they used divi
and other contrivances was made the basis of a charge o
After some years of persecution they were placed in prison (
baron in the Bastile and his wife in Vincennes, where they d
1645. Raymond[2] writes:

> In magnifying the art of discovering mines and springs, and the skill
> this purpose, she [the baroness, in "The restitution of Pluto"] gives a de

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[1] Raymond, R. W., The divining rod: Am. Inst. Min. Eng. Trans., vol. 11, p. 419,

[2] Idem, pp. 420-421.

> neans employed, showing that these hidden treasures are to be detected, (1) by ng, which is the least important way, (2) by the herbs and plants which grow e streams of water, (3) by the taste of the waters which flow from them, (4) by the rs which arise from them at sunrise, and (5) by the use of 16 scientific instruments 7 rods [the 7 rods of Basilius Valentinus] connected with the 7 planets," etc.

> e first four means were undoubtedly real and really employed. Under the fifth we have an illustration of what is so common in the alchemistic and other medie- vriters, namely, the covering of the facts of nature and the methods of investigation assumed mystery to hide them from the vulgar.

his raises the interesting question as to the extent to which lligent persons may have used divining rods in the early days for sole purpose of concealing from the uninitiated their real methods prospecting. One can hardly overestimate the respect for the ining rod that would be created among common miners if a man eal ability publicly attributed his success to its use, and it may that the deep-rooted hold which the superstition obtained on the ular mind was due to just such circumstances as this.

ORIGIN OF "WATER WITCHING."

'he above quotation from the Baroness Beausoleil is interesting for the reason that in it the divining rod is mentioned as a means discovering springs. The Beausoleils are believed to have been uential in bringing about the use of forked twigs in searching for er, although Barrett[1] writes as follows in regard to an account ich he finds in a Life of Saint Teresa of Spain:

> eresa in 1568 was offered the site for a convent to which there was only one objec- —there was no water supply; happily, a Friar Antonio came up with a twig in hand, stopped at a certain spot, and appeared to be making the sign of the cross; Teresa says, "Really I can not be sure if it were the sign he made, at any rate nade some movement with the twig and then he said, 'Dig just here'; they dug, lo! a plentiful fount of water gushed forth, excellent for drinking, copious for hing, and it never ran dry."

Barrett regards this the first historical reference to "dowsing" for ter, but Mager[2] and Klinckowstroem[3] mention a paper written Claude Galien in 1630 on the supposed discovery of the Chateau- ierry mineral water by Baroness Beausoleil as the first reference. any rate, from about this time on the divining rod was used in thern Europe as much in the search for water as in the search mines, although, according to Barrett, it was not used for this rpose in England until near the end of the eighteenth century.

This new application of the divining rod no doubt tended to popu- ize it. It had been of interest chiefly to miners, and outside mining districts it was probably known only in a vague sort of y. But as a "water finder" it became more generally known, and in the very nature of things its successes must have out its failures, just as, taking the country over, successful well ber unsuccessful ones.

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[1] Barrett, W. F., Psychical research, p. 171, 1911.

[2] Mager, Henri, Les moyens de découvrir les eaux souterraines et de les utiliser, p. 327, 1912.

[3] Klinckowstroem, Graf Carl v., Bibliographie der Wünschelrute, p. 38, 1911.

ECCLESIASTICAL CONTROVERSIES.

The divining rod continued to be a favorite subject with a writers until about 1660, when a new turn of affairs wa about largely by the Jesuit Father Gaspard Schott, wh "Magiae universalis naturae et artis" (1659), denounced instrument controlled by the devil. The subject was then by the church, and for more than 100 years it was hotly d churchmen. Some approved of the rod and authorized i church property; others condemned it and threatened those it with excommunication. Gaspard Schott later expressed that its movements were probably not caused by the "monks of great piety have used it with really marvelou and affirm positively that the movement is entirely natura it does not at all proceed from dexterity or from the s imagination of him who uses it," and he and A. Kircher first to advance the theory that the movement of the rod unconscious muscular action.

About 1671 Matthaeus Willenius published an account of cury wand, in which he stoutly defended the use of the rod, and two years later Jacques Le Royer announced that rial of which the rod is made is of little consequence, as he c have obtained equally good results with rods made of woo ivory, gold, or silver.

In 1674 the Jesuit priest Dechales wrote (in "De fon uralibus"):

> There are two things which astonish me in this experience: Why th only in the hands of certain persons, and second, why this rod serves eq locate both underground streams and mines.

In 1675 J. C. Frommann, a doctor of medicine, ridiculed explained the movements of the rod as a sleight-of-hand compared the mystery of the rod with the mystery of rep In 1684 another doctor of medicine (G. B. de Saint-Ro plained the movements of the rod as due to emanations from minerals and underground streams.

USE OF THE DIVINING ROD IN DETECTING CRI

Prior to 1692 the divining rod had been used in trying minerals and water and possibly to some extent for other But in that year an incident occurred in southern Fra added greatly to the notoriety of the divining rod and ex field of operation into the moral world, in which, accordin iters (p. 9), rods for divination had their origin. This incident, ich is described in great detail by several writers,[1] was the appre- nsion and identification of a criminal through the agency of a asant of Dauphiny named Jacques Aymar, who claimed the ability trace fugitives by the use of divining rods.

Interest in this case was intense and widespread and called forth large amount of literature. In commenting on the case Barrett[2] ys:

> 'he other one, a hunchback, who was arrested, confessed the crime and was exe- ed: the last person in Europe who suffered that terrible penalty of being "broken he wheel." * * * Strangely enough the depositions made at the trial showed t Aymar was correct in every detail, witnesses testifying to the flight and halting ces of the culprits in the very places Aymar had indicated. * * * Aymar ame notorious throughout Europe. He was, however, subsequently somewhat credited owing to his failure in some tests devised by the Prince de Condé.

But Raymond, in a decidedly more skeptical treatment of the mat- , raises some illuminating questions in regard to Aymar's integ- y. His comment on the work of Aymar[3] includes the following tements:

> 'his man, Jacques Aymar by name, was sent for—or rather it was not necessary to d for him, since he proved to be already on hand in the city by the time it was ided to engage his services. This fact is significant as giving the key to what ned out to be an extraordinary piece of clever detective work. A careful analysis he numerous official and other records of this case shows it to be quite possible t the diviner had obtained important clues before he was publicly set to work. * * The subsequent tracking of a hunchback would be no very difficult matter. * * But this achievement of the rod, attested as it was by official records and the public confession and execution of the criminal made a great sensation in ınce. * * * Aymar was called to Paris, where both the court and the savants erested themselves greatly in his mysterious powers. Many marvelous feats are orted of him there; but the shrewd and rigorous experiments of the Prince de Condé osed the emptiness of his pretensions * * *. As late as 1703 this man was ployed during the civil war to point out with his divining rod Protestants for ssacre, under the plea of punishment for crimes they had committed.

The belief that the divining rod was an instrument invented by tan for the confusion of men was no doubt as old as the superstition elf, but, as previously indicated, it was greatly strengthened when 1659 Gaspard Schott proclaimed that the rod was controlled by e devil, thereby identifying it with witchcraft and bringing it within e jurisdiction of the Church. Although the use of the divining rod fered essentially from witchcraft in many respects, nevertheless, addition to its direct implication by its ecclesiastical adversaries, ere was in some respects a very close relation between the two, as

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Baring-Gould, Sabine, Curious myths of the middle ages, p. 54, 1894. Mager, Henri, Les moyens de ouvrir les eaux souterraines et de les utiliser, pp. 362–365, 1912.

Psychical research, ch. 12, p. 172.

Raymond, R. W., The divining rod: Am. Soc. Min. Eng. Trans., vol. 11, pp. 424–427, 1883.

is suggested by the use of incantations in connection with
and to this relationship may be ascribed in some measure the
ening of belief in the rod. The significance of this lies in th
witchcraft, at the time of the Aymar episode, had become
and anything—even the simplest occurrences of everyday li
by any stretch of the imagination could be suspected of in
with witchcraft, became a subject of discussion and the ba
opinions and beliefs.

In view of the prevalence of such beliefs as this reign o
implies, it is by no means difficult to account for the credence
to such claims as those made by Jacques Aymar. Moreo
sidering the ordeals of torture inflicted on persons accused
to extract confessions, by a strange perversion called "vo
and often inflicted on the witnesses as well, and considerin
fact that a public execution was sometimes regarded as
diverting spectacle well worth some effort to bring it a
testimony supporting the claims of Aymar, as repeated to
bined even with the reported confession of the accused, fall
of establishing the merit claimed by Aymar, or even the g
hunchback who was executed.

In 1701 the Inquisition issued a decree against the furt
the divining rod in criminal prosecution, and this use of t
rapidly came to an end.

SCIENTIFIC CONTROVERSIES.

LEBRUN AND OTHERS.

For about 80 years after the decree by the Inquisition
its use for the detection of criminals the divining rod contin
a fruitful subject for debate among ecclesiastical authoriti
whom was Pierre Lebrun, who in 1692 first suggested the
"prior intention," but in 1780 it was dropped and received
official recognition by churchmen. But the time was the
controversies along an altogether new line, namely, the a
explain water witching as an electrical phenomenon. A
time the study of electricity was making great progress,
through the work of Volta and Galvani, and the demonst
Galvani that amputated legs of frogs could be made to tw
the influence of electrical stimuli was at once misinterpreted
cates of the divining rod as giving a scientific basis for water

THOUVENEL.

The controversies relating to electrical phenomena were
Pierre Thouvenel, a physician to Louis XVI, who interest
in another peasant of Dauphiny, Barthélemy Bleton,
Jacques Aymar, had acquired notoriety as a "hydroscope."

Bleton was born at Bouvantes, in Dauphiny, in 1750, or possibly a few years earlier, was brought up by charity in a monastery, and became a herdsman. The first manifestation of "hydroscopic" faculties in Bleton is described in the following paragraph quoted from Barrett,[1] who gives it as a translation from Thouvenel's correspondence dated at Dijon, April 14, 1781:

> Bleton when 7 years of age had carried dinner to some workmen; he sat down on a stone, when a fever or faintness seized him; the workmen having brought him to heir side, the faintness ceased; but each time he returned to the stone he suffered gain. This was told to the Prior of the Chartreuse, who wished to see it for himself. Being thus convinced of the fact, he had the ground under the stone dug up; there hey found a spring, which, I am told, is still in use to turn a mill.

Thouvenel heard of Bleton and chose him as a fit subject on whom o test his notions of "animal magnetism," and as a result published n elaborate essay which he called "Mémoire physique et médicinal, montrant des rapports évidents entre les phénomènes de la baguette divinatoire, du magnétisme et de l'électricité." The following account by Raymond[2] presents the principal facts in regard to Bleton's chievements in concise form:

> In the first place, Bleton apparently did not profess to discover immaterial qualities or facts, but chiefly confined himself to the detection of running water. In the second place, he frankly avowed that the rod possessed no power in itself by virtue f its form or material, and that it was merely an index, outwardly exhibiting to the spectators his inward feeling. This feeling the doctor declared to be a tremor, attacking first the diaphragm and communicating itself through the body and hands to the od. In the third place this tremor was found by Dr. Thouvenel to be weakened, hough not destroyed, when Bleton was on a tree or ladder or another person's shoulder, instead of the ground, or when he touched electrified substances; but the tremor and also the movement of the rod were completely stopped when Bleton was insulated from the ground. Upon facts of this kind he based his electrical theory. remark, by the way, that the observations and the theory of Mr. Latimer, in his recent work on the divining rod, already mentioned, recall in a striking manner the performances of Bleton and the theory of Thouvenel. Mr. Latimer claims to have made the new discovery that the effect of the divining rod is destroyed by insulating the practitioner, as, for instance, by placing him upon a platform supported by glass bottles. If he had known how thoroughly this claim had been examined and refuted, almost exactly 100 years ago, he would have had less faith in its novelty and value.
>
> Thouvenel's book made no little sensation, and in 1782 Bleton was called to Paris, where a remarkable series of experimental tests were applied to him. A newspaper report of the day declares that in the presence of many thousands of spectators he followed a subterranean aqueduct in the garden of the Luxembourg for 15,000 yards without a mistake. The chief engineer of the waterworks is reported to have said that the trace was so accurate that if the maps of his office had been lost, Bleton's footsteps would have constituted a complete survey to replace them. It is just possible that the Journal de Paris was tempted to make a sensation of this case, and is also quite possible that a keen observer might notice indications other than those of his own diaphragm, by which he could follow the line of buried pipes. large number of experiments, more calmly reported, certainly do not sustain the

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[1] Barrett, W. F., On the so-called divining rod: Soc. Psych. Res. Proc., vol. 15, p. 257, 1900.

[2] Raymond, R. W., The divining rod: Am. Inst. Min. Eng. Trans., vol. 11, pp. 431-433, 1883.

enthusiasm of this account. It was found, for instance, that Bleton oft
over running water, when blindfolded, without noticing it; and that wh
several times over the same course he would not point out accurately each
spots which he had previously marked. For example, of 16 points once i
he recognized with the rod on the second round but eight and missed the ot
A single point to which he was repeatedly brought blindfold he indica
times and missed three times. Of seven channels of running water whi
made to cross repeatedly, he indicated one once in four times, another on
times, and another once in three times, while still another, which he cross
spots, affected his diaphragm at one crossing and not at all at the other.
lation experiment was repeated by a physician at Paris. At a point wher
rod was powerfully affected by alleged subterranean water, he was mount
stool with glass legs, and immediately the rod ceased to be affected.
stool was removed, however, and he stood upon the ground, the rod re
sensitiveness. But Dr. Charles, who conducted this experiment, took
while Bleton stood upon the stool, to bring the top, without his knowle
electrical communication with the earth by means of a good conductor, thu
ing the insulation completely, though the hydroscopist supposed it still
Under these circumstances the rod remained inactive, and the destruction
tion did not produce the slightest result. This was declared at the time to
of Bleton's charlatanry; but, as we shall see hereafter, it is equally consis
the hypothesis of unconscious mental and muscular action.

As a final test of Bleton's capacity as a hydroscopist, he was taken blindfol
new church of Saint Genevieve, where there was known to be no wat
feet below the floor, the vaults, foundations, etc., actually extending all tha
below. Here he professed to discover at numerous points large and small
water. Thouvenel subsequently asserted that his protégé had been affecte
rents of damp air circulating in the cellar, but this explanation was univer
sidered as a desperate attempt to maintain a theory already brought into
by experimental tests. Bleton, however, though he ceased to be seriously
by impartial scientists, continued to receive much attention, and to do a
business, both in Paris and subsequently in the provinces. Here, howev
longer worked blindfold or professed to see with his diaphragm. He
like the ordinary water diviners, with open eyes, studying all the natural in
and coming to his decisions with abundant leisure; and under the circums
is beyond doubt that he rendered many valuable services to landed prop
successfully locating wells. In many cases, however, he failed entirely,
reported that even in those in which he succeeded, he was seldom right as to
at which water would be found or the quantity which would be obtained.
be mentioned that in Dauphiny, where Bleton discovered a large number o
he was regarded with an esteem never given to Aymar and some other famo
scopists. In other words, the people who knew most about the art of di
water pronounced Bleton to be a real expert, while they believed Aymar and
to be more or less charlatans. A review of all the facts leaves little doub
Bleton's case there was an unusually large proportion of the skill of the p
combined with rather less than usual of the mysterious claims of the wizar

At this time many diviners acquired notoriety, including P
and Pennet, of Dauphiny, and Campetti, of Italy, but their
differed in no significant respect from that of Bleton. The
of this time was the patronage of diviners by scientists
attempt to apply hypotheses of animal magnetism and te
electricity to the supposed operation of the divining rod.

CHEVREUL AND FARADAY.

During the first half of the nineteenth century the phenomena of table turning" was introduced, and became so popular that it was ften employed in drawing-room entertainments. During this time so the so-called "magic pendulum," which had persisted from ntiquity as a rather obscure divining instrument, was popularized nd an elaborate system of electrical hypotheses was based on its onduct. The magic pendulum consists of a finger ring, watch, piece f metal, or any other suitable weight, attached to the end of a cord nd suspended from the hand. In ancient times it was used to fore- ast events by suspending it over a disk on the margin of which were ie letters of the alphabet, the pendulum being brought to rest and eld steadily until it finally began to swing, thereby pointing out arious letters which formed or suggested the words of a prophecy. t is said to be fairly common as a toy at the present time and is still ccasionally used seriously by superstitious people in this country. t the beginning of the eighteenth century it was being used, like ie divining rod, in attempts to locate well sites, for which purpose is still used to some extent. In 1812, however, Michel Eugene hevreul made an investigation of the subject and concluded that ie whole phenomenon was a result of involuntary muscular move- ients in the hand, induced by mental processes.

In 1854 Michael Faraday showed that table turning was due to ivoluntary muscular movements; and in the same year Chevreul, s a member of a committee appointed by the Academy of Science investigate the divining rod and the magic pendulum, wrote with egard to the divining rod:

> It is evident to my eyes that the cause of the movement of the wand does not belong the physical world, but to the moral world; I think that, in most of the cases in and, in which the wand is held by an honest man who has faith in it, the movement the consequence of an act of the mind of that man.

The foundation of the science of psychology was being laid at his time, and psychical phenomena were just beginning to be ecognized in a new light. In the conclusions of Faraday and hevreul, therefore, may be recognized the first application of hose new conceptions of mental processes. This theory was finally laborated in an exhaustive treatment of the subject by Barrett. See pp. 22–23.)

LATIMER.

While all these investigations were being conducted in Europe the ivining rod was enjoying a peaceful existence in the United States, orked twigs being used more or less in prospecting for water, oil, nd other mineral deposits. But in 1875 Charles Latimer[1] read before the Civil Engineers' Club of the Northwest an essay on "Th rod," which was later published (1876) with additional which he undertook to prove that the operation of the ro on electrical currents transmitted from the ground through inducing a magnetic field between the rod and the ground. explained a method by which he claimed to be able to the amount of water available and the depth at which it reached.

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[1] Latimer, Charles, The divining rod: virgula divina baculus divinatoribus, water witching, Cleveland, 376.

RAYMOND.

In 1883 R. W. Raymond[1] published his essay on "Th rod," which contains a historical outline of the subject an conclusions based especially on the works of Chevreul. It with the following highly rhetorical epitaph on this superstition:

> To this, then, the rod of Moses, of Jacob, of Mercury, of Circe, of Beausoleil, of Vallemont, of Aymar, of Bleton, of Pennet, of Campetti— Latimer—has come at last. In itself it is nothing. Its claims to virtues Deity, from Satan, from affinities and sympathies, from corpuscular ef electrical currents, from passive perturbatory qualities of organo-electr hopelessly collapsed and discarded. A whole library of learned rubb which remains to us furnishes jargon for charlatans, marvelous tales fo amusement for antiquarians; otherwise it is only fit to constitute part of "History of human error." And the sphere of the divining rod has shr authority. In one department after another it has been found useles the one application left to it with any show of reason it is nothing un skillful hands, and whoever has the skill may dispense with the rod. It b "the magic pendulum" and "planchette," among the toys of childre be worthy the attention of scientific students, it is the students of psy biology, not of geology and hydroscopy and the science of ore deposi profitably consider it.

BARRETT.

In 1891 W. F. Barrett,[2] professor of physics in the Royal Science for Ireland, in the interest of the Society for Research, undertook a very laborious investigation of wa ing, or dowsing, as it is called in England, and later pub results in two large volumes.

Barrett concluded that the movement of the rod or fork due to unconscious muscular action arising from subcons involuntary "suggestion" impressed on the mind of the do that this subconscious suggestion may be merely an autos or a suggestion derived through the senses from the env but that in a certain number of cases it appears to be due to scious perceptive power commonly called clairvoyance. H ns were therefore in a sense favorable to water witching, although npletely refuting all claims that there is any physical relation ween the underground water and the forked twig or its manipuor, and definitely relegating the subject wholly to the obscure realm occultism with other varieties of fortune telling.

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[1] Raymond, R. W., The divining rod: Am. Inst. Min. Eng. Trans., vol. 11, pp. 411-4 lished also in U. S. Geol. Survey Mineral Resources, 1882, pp. 610-626, 1883.

[2] Barrett, W. F., On the so-called divining rod or Virgula divina: Soc. Psych. Res. Pro 15, 1897, 1901.

MAGER.

n all its weird history no more extravagant and absurd claims were r made for the divining rod than those which are maintained at present time by Henri Mager. (See p. 8.) Mager is an enthustic champion of divining rods, magic pendulums, and his own chanical device for locating water and ores. His hypotheses are sented in his three elaborate volumes—"Les moyens de découvrir eaux souterraines et de les utiliser," 1912; "Les sourciers et leurs océdés," 1913; and "Les influences des corps minéraux," 1913—and his pamphlet "A new method for the study of mining fields and for ding ore embedded in deep ground," 1914. At almost every step in advance of science and philosophy some one has attempted to explain supposed operation of the divining rod by means of the latest entific theories, and Mager's work is in accord with precedent. s claims are built on dicta or speculations in which use is made of terminology of students of radioactivity and electromagnetism.

RECENT INVESTIGATIONS.

It remains to be stated that there are several societies in Germany ose sole object is said to be the study of the divining rod, and at a subcommittee of the commission of scientific studies in the reau of waters and forests of the department of agriculture of ance was appointed in 1910 to investigate the subject and in 1914 s still investigating.

MECHANICAL WATER FINDERS.

About 1640 Baroness Beausoleil, in "The restitution of Pluto" (see 16), listed, among means of discovering mines and springs, the use 16 "scientific instruments." This is the earliest reference to such struments that has been discovered in the preparation of this report, d it is a matter of considerable interest that even at this early date single prospector should manifest so wide an acquaintance with vices for finding water and ore. It is certain that Beausoleil's 16 ere the forerunners of a prolific race. At least 24 patents of this ture are now on file in the United States Patent Office, but this is no dex to the number which have been rejected and which have never en offered for patent in this country, not to mention foreign invenons.

See Joly, J., Radioactivity and geology, 1909, and Bauer, L. A., The physical theory of the earth's gnetic and electrical phenomena: Terrestrial magnetism and atmospheric electricity, vols. 15 and 16, 0, 1911.

Most of the present devices are magnetic or electrical ins which, taken together, cover almost every application of n and electricity. They range from ordinary dip needles to t and devices using wireless waves. Among the most widely a instruments of this kind are W. Mansfield's "Patent automa and oil finders," Henri Mager's "Indicator of current groun and Adolf Schmids's "Device for detecting subterranean Mansfield's instrument was denied a patent in the United the ground that it was anticipated by the patent of Adolf Mager's instrument, which is described in all his publica p. 23), is admitted by him to be only a modification of device.

In the letters patent[1] of the Schmids device it is stated apparatus will "indicate certain atmospheric changes, the n cause of which are not yet understood but which manifest t in a peculiar way in the neighborhood of the source and cour terranean waters by rapid oscillations of the pointer of the

The instrument is described as a hollow glass cylinder h axis around which is spirally wound a soft-iron wire in layer separated from one another by paraffined paper, and at by layers of tin foil. The outside layer of the spool is cov paper. The wire of this spool forms an open circuit. The spool is covered with a glass dial plate having at its cente on which a pointer or needle oscillates.

It is claimed that when the instrument is in the vicinity o or a stream of subterranean water the needle will after a tim rapidly.

In the literature advertising its "automatic water and oil circulated by the Mansfield Co., of Liverpool, England, the claims are made:

> The principle on which the instrument works is the indicating of the currents which flow between earth and atmosphere, and which seeking greatest conductivity, are always strongest in the vicinity of subterra courses, the waters of which are charged with electricity to a certain degree. observations, wooden pegs are placed at intervals of 20 paces in a direct southeast to northwest. The instrument is tried over each of these pegs i should the needle move on any one of them, tests are made all round it, a where the greatest movement of the needle is obtained is where the borin made. If the needle does not move subterranean water does not exist un where the instrument is fixed. * * * The instrument indicates wa flowing underground in a natural state and not water pipes or sources that l up to daylight.

Systematic magnetic observations have been made for years, and a complete magnetic survey of the earth, under tion of the Carnegie Institution of Washington, has been in r a number of years, but this survey has not yet disclosed the exist- ice of local earth-air currents on which to base a method of utilizing ich currents in determining underground conditions. In view of iis lack of knowledge any invention based on the assumption that ich currents exist, as, for example, the Schmid patent, is subject to ie general criticism that it is unsound in principle, or at least that, ke the divining rod, it can be subjected to no conclusive scientific st. The practical use of such instruments, moreover, seems to be compatible with the known instability of the magnetic and electric ate of the earth and the atmosphere, in which disturbances of greater less degree are constantly taking place. Investigations[1] have iown that magnetic disturbance is nearly continuous; that an itirely undisturbed day is abnormal. Some magnetic disturbances e local; others affect the whole earth simultaneously.[2] Bauer[3] rites:

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[1] Patent No. 841188, Jan. 15, 1907.

> The magnetic disturbances experienced by the earth are generally of a very com- icated nature and reach at times startling magnitudes. Thus during the most markable magnetic storm of which there is any record—the one of September 25, 09—the compass needle in the vicinity of the city of Washington suffered a change 5 degrees in the short space of a quarter of an hour and the force acting on it passed rough a change during the same period amounting to 10 per cent of its full lue. * * *
>
> I confidently expect, as soon as a complete analysis has been made of magnetic sturbances covering the greater portion of the earth, it will be found that * * * e disturbances will themselves reveal effects from terrestrial, continental, regional, id even local causes (earth currents, for example, whose path and intensity depend on local character of soil, etc.).[4]
>
> Since the earth's magnetic state is known to be of a very heterogeneous character, quiring an exceedingly complicated mathematical expression for even a very proximate representation, it may be confidently expected that any magnetic change disturbance, from whatever source it may come and of however simple a type it ay originally be, by the time it has entered the earth's field and has impressed itself on our magnetic instruments, will have been converted into an equally complex pe to that of the earth's magnetism itself.[5]

Further study of this subject tends merely to strengthen the belief iat magnetic disturbances may be due to causes so many and various iat no confidence can reasonably be placed in any claim that the scillations of a magnetic needle indicate the occurrence of available round water, much less the depth at which water can be reached or ie quantity that can be obtained; and it confirms the opinion that, i the present state of knowledge, any such claim is purely specu- itive.

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[4] Op. cit. (Analysis, etc.), p. 25.

[5] Idem, p. 22.

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